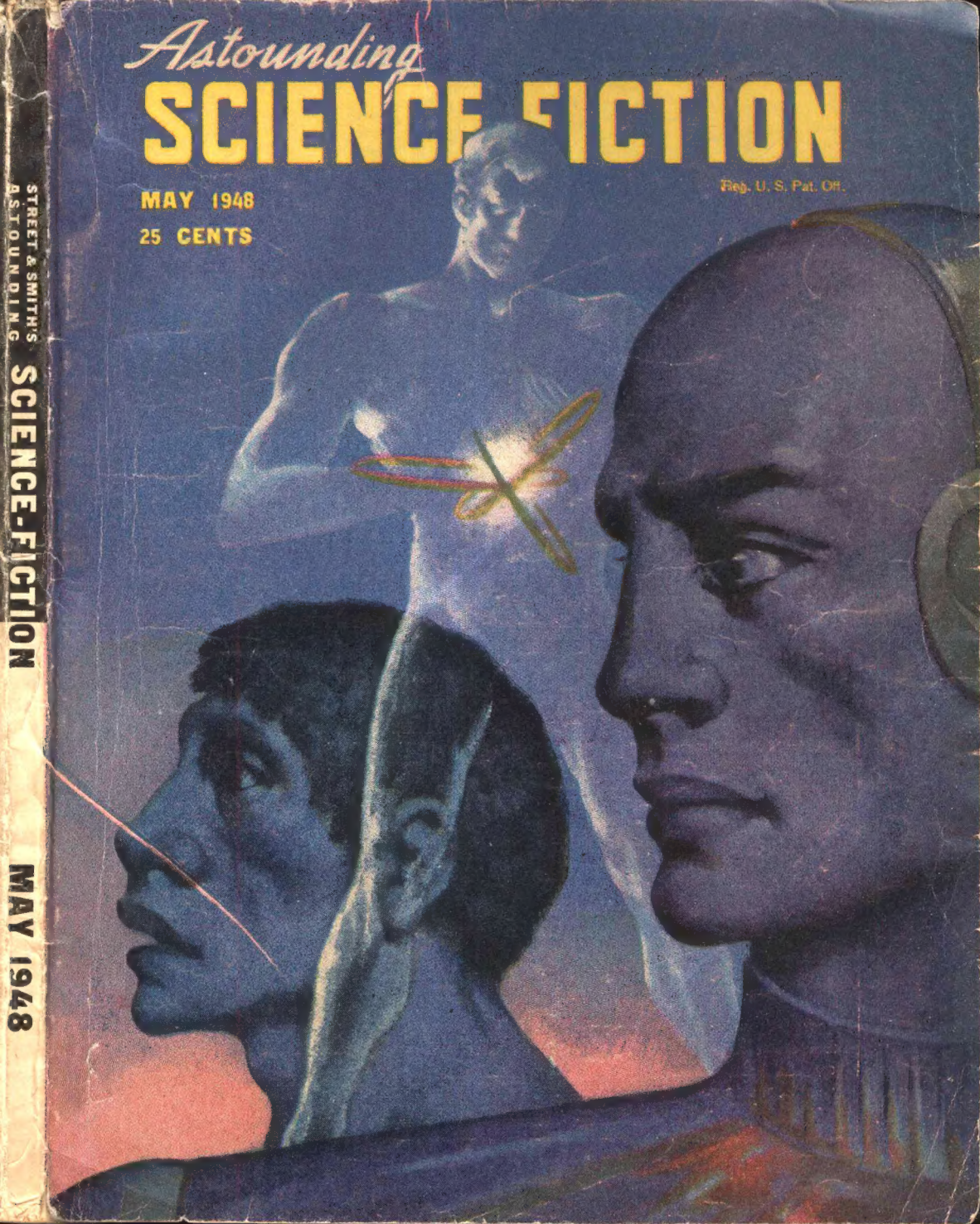
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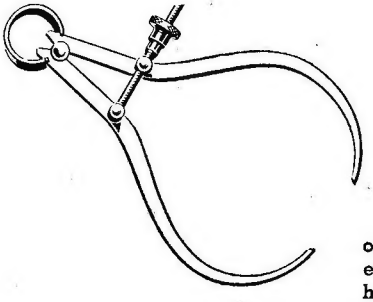

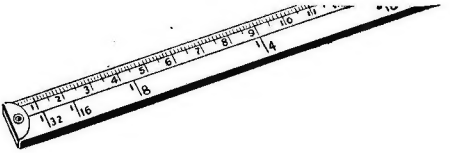

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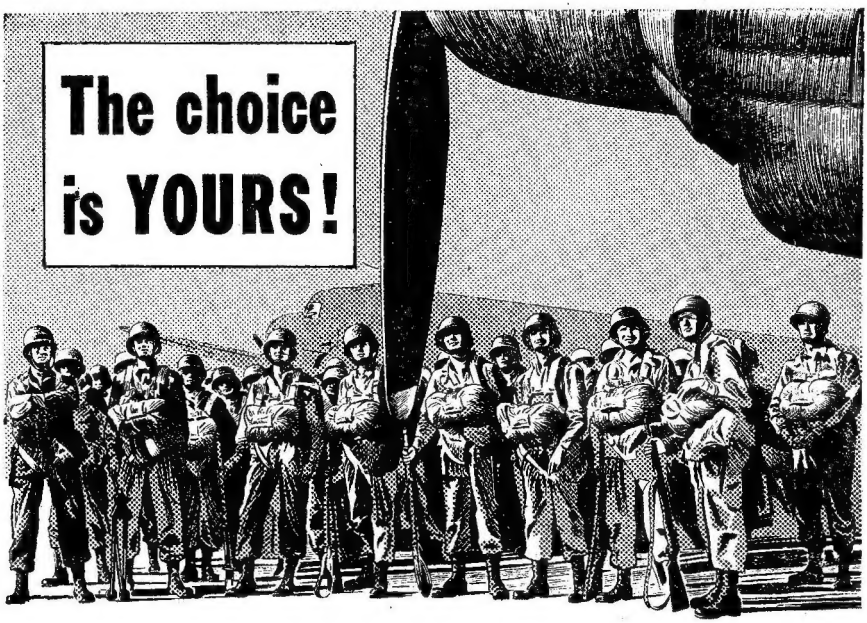

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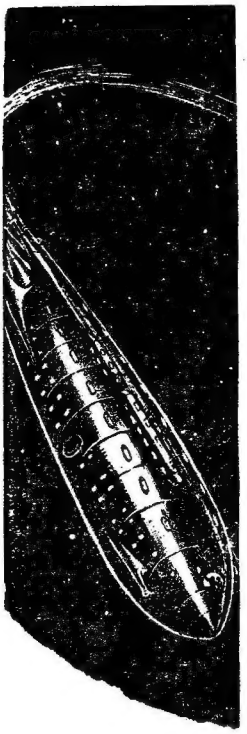

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Editor
JOHN W. CAMPBELL, JR.

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$2.50 per Year in U. S. A. Printed in [redacted] the U. S. A. 25c per Copy

NEXT ISSUE ON SALE MAY 18, 1948

SECOND SOLUTION

When the Manhattan Project started, the basic problem was to manufacture an atomic bomb, a goal that required the solution of a predecessor problem—the separation of a fissionable isotope from nonfissionable material. Four distinct, completely workable solutions to the problem were developed and operated: the gas-diffusion process, the electromagnetic process, and thermal diffusion in liquid were used at Oak Ridge. At Hanford, chemical separation of synthetic plutonium from uranium was used. Each of these constituted a complete, valid, and workable solution to the problem.

The Manhattan Project was a unique setup, in that, under wartime pressure, it did equivalent things in parallel, spurred by the danger that if one only were selected and developed, it might prove unworkable, and the hour, then, too late for recovery. Normally, some one solution to a technical problem is tried out, a few preliminary designs made, preliminary designs of other suggested solutions tried, and then one of the suggestions is developed and used, the others discarded. That's by far the cheaper way of operating.

That it is not necessarily the best is not so evident. That it leaves open the way to a lot of interesting speculation, however, is—and science-fiction hasn't done as much speculation in that direction as it might. Each of our major devices today constitutes *an* answer to a problem—it's not necessarily the *best* answer, and it is doubtful that any answer to any problem is the *only* answer. Even in arithmetic and algebra multiple answers of equal validity normally exist. In the complex fields of technology, hundreds of untried devices may be possible, many perhaps better answers than the ones we have.

One example of that basic factor has come to light relatively recently. Phillips of Eindhoven, The Netherlands, manufactures radio tubes, radio sets, electric lights, et cetera, and has found its market limited by lack of power lines. Seeking a home power plant that Europe could use, keeping in mind that gasoline is not freely available there as it is in America, they sought a different answer to the problem of a small engine. They went back a century or more to a discarded solution to that problem —a solution discarded at the time

because the internal combustion heat-engine seemed the better answer. There are a lot of forms of heat-engines now known; the reaction types, including rockets, turbo-jets, reso-jets and ram-jets, the internal combustion types including gasoline and Diesel types, and, in current general use, only one external-combustion type, the steam-engine group, which includes the turbines and reciprocating types. At one time, the hot-air heat-engine was used, but it dropped out of the competition.

With modern heat-engine theory, modern mechanical methods, modern metallurgy, and modern research techniques, Phillips reopened the case of the hot-air engine. It shows up with some dazzling possibilities. First, it's essentially an external combustion engine, and can run on coal, wood, gasoline, kerosene, alcohol, or the hot gases exhausted from a furnace—any source of heat. Second, with modern methods, it shows an efficiency of over thirty per cent, well ahead of the best gasoline engines, and up with the best Diesel engines. It is far simpler, has fewer moving parts, and represents a much simpler lubrication problem than does any internal combustion engine. And in addition, there being no violent chemical reactions involved inside the engine, it runs like a steam-engine, smoothly and quietly, instead of noisily. The "exhaust" of the hot-air engine is simply the gases escaping from its heat-source, and as noisy as a burning candle. The engine can, with modern metallurgy, be light, compact, highly efficient—and operate on anything that will burn.

By picking the internal combustion gasoline engine, men missed developing the hot-air engine. It's easier to make a moderately efficient, moderately light gasoline engine, starting from scratch, than to do the same with a hot-air engine—so men took that turn. But a high-efficiency, very-light gasoline engine runs into severe problems that have driven us to a development of petroleum chemistry we would never have attained had we selected the hot-air engine. The ramifications consequent on picking the gasoline engine for development are almost incalculable. Distillation theory, hydrocarbon chemistry, plastics and rubber chemistry, all owe an inestimable debt to the fact that men, on this planet, guessed—and perhaps guessed very wrong—that the gasoline internal combustion engine, rather than the hot-air engine was the best answer.

Wonder what we'd have developed instead if we'd taken the hot-air engine road?

THE EDITOR.

* * * * * * * * * *

THE RULL

BY A. E. Van VOGT

***It had** been intended as a test—but the test went wrong. But it was very hard for the human to appreciate or guess at the Achilles Heel of the incredible Rull!*

Illustrated by Orban

Professor Jamieson saw the other space boat out of the corner of one eye. He was sitting in a hollow about a dozen yards from the edge of the precipice, and some score of feet from the doorway of his own lifeboat. He had been intent on his survey book, annotating a comment beside the voice graph, to the effect that Laertes III was so close to the invisible dividing line between Earth-controlled and Rull-controlled space that its prior discovery by man was in itself a major victory in the Rull-human war.

He wrote: "The fact that ships based on this planet could strike at several of the most densely populated areas of the galaxy, *Rull or human,* gives it an AA priority on all available military equipment. Preliminary defense units should be set up on Mount Monolith, where I am now, within three we—"

It was at that point that he saw the other boat, above and somewhat to his left, approaching the tableland. He glanced up at it—and froze where he was, torn between two opposing purposes.

His first impulse, to run for the lifeboat, yielded to the realization that the movement would be seen instantly by the electronic reflexes of the other ship. For a moment, then, he had the dim hope that, if he remained quiet enough, neither he nor his ship would be observed.

Even as he sat there, perspiring with indecision, his tensed eyes noted the Rull markings and the rakish design of the other vessel. His vast knowledge of things Rull enabled him to catalogue it instantly as a survey craft.

A *survey* craft. The Rulls had discovered the Laertes sun.

The terrible potentiality was that, behind this small craft, might be fleets of battleships, whereas he was alone. His own lifeboat had been dropped by the *Orion* nearly a parsec away, while the big ship was proceeding at antigravity speeds. That was to insure that Rull energy tracers did not record its passage through this area of space.

The *Orion* was to head for the nearest base, load up with planetary defense equipment, and return. She was due in ten days.

Ten days. Jamieson groaned inwardly, and drew his legs under him and clenched his survey book in the fingers of one hand. But still the possibility his ship, partially hidden under a clump of trees, might escape notice if *he* remained quiet, held him there in the open. His head tilted up, his eyes glared at the alien, and his brain willed it to turn aside.

Once more, flashingly, while he waited, the implications of the disaster that could be here, struck deep. In all the universe there had never been so dangerous an intelligence as the Rull. At once remorseless and immune to all attempts at establishing communication, Rulls killed human beings on sight. A human-manned warship that ventured into Rull-patrolled space was attacked until it withdrew or was destroyed. Rull ships that entered Earth-controlled space *never* withdrew once they were attacked. In the beginning, man had been reluctant to engage in a death struggle for the galaxy. But the inexorable enemy had forced him finally to match in every respect the tenacious and murderous policies of the Rull.

The thought ended. The Rull ship was a hundred yards away, and showed no signs of changing its course. In seconds, it would cross the clump of trees, which half-hid the lifeboat.

In a spasm of a movement, Jamie-

son launched himself from his chair. Like a shot from a gun, with utter abandon, he dived for the open doorway of his machine. As the door clanged behind him, the boat shook as if it had been struck by a giant. Part of the ceiling sagged: the floor staggered towards him, and the air grew hot and suffocating.

Gasping, Jamieson slid into the control chair, and struck at the main emergency switch. The rapid fire blasters huzzaed into automatic firing positions, and let go with a hum and deep-throated *ping*. The refrigerators whined with power; a cold blast of air blew at his body. The relief was so quick that a second passed before Jamieson realized that the atomic engines had failed to respond. And that the lifeboat, which should already have been sliding into the air, was still lying inert in an exposed position.

Tense, he stared into the visiplates. It took a moment to locate the Rull ship. It was at the lower edge of one plate, tumbling slowly out of sight beyond a clump of trees a quarter of a mile away. As he watched, it disappeared; and then the crash of the landing came clear and unmistakable from the sound board in front of him.

The relief that came was weighted with an awful reaction. Jamieson sank back into the cushions of the control chair, weak from the narrowness of his escape. The weakness ended abruptly as a thought struck him. There had been a sedateness about the way the enemy ship fell. *The crash hadn't killed the Rulls aboard.*

He was alone in a damaged lifeboat on an impassable mountain with one or more of the most remorseless creatures ever spawned. For ten days, he must fight in the hope that man would still be able to seize the most valuable planet discovered in a century.

He saw in his visiplate that it was growing darker outside.

Jamieson opened the door, and went out onto the tableland. He was still trembling with reaction, but there was no time to waste.

He walked swiftly to the top of the nearest hillock a hundred feet away, taking the last few feet on his hands and knees. Cautiously, he peered over the rim.

Most of the mountain top was visible. It was a rough oval some eight hundred yards wide at its narrowest, a wilderness of scraggly brush and upjutting rock, dominated here and there by clumps of trees. There was not a movement to be seen, and not a sign of the Rull ship. Over everything lay an atmosphere of desolation, and the utter silence of an uninhabited wasteland.

The twilight was deeper, now that the sun had sunk below the southwest precipice. And the deadly part was that, to the Rulls, with their wider vision and more complete sensory equipment, the darkness would mean nothing. All night long, he would have to be on the defensive against beings whose nervous systems outmatched his in every function except, possibly, intelligence. On that level, and

that alone, human beings claimed equality.

The very comparison made him realize how desperate his situation was. He needed an advantage. If he could get to the Rull wreck,and cause them some kind of damage before it got pitch dark, before they recovered from the shock of the crash, that alone might make the difference between life and death for him.

It was a chance he had to take.

Hurriedly, Jamieson backed down the hillock, and, climbing to his feet, started to run along a shallow wash. The ground was rough with stones and projecting edges of rock and the gnarled roots and tangle of hardy growth. Twice, he fell, the first time gashing his right hand, the second time his right foot.

It slowed him mentally and physically. He had never before tried to make speed over the pathless wilderness of the tableland. He saw that in ten minutes he had covered a distance of just under seventy-five yards.

Jamieson stopped. It was one thing to be bold on the chance of making a vital gain. It was quite another to throw away his life on a reckless gamble. The defeat would not be his alone, but man's.

As he stood there, he grew aware of how icy cold it had become. A chilling wind from the east had sprung up. By midnight, the temperature would be zero. For it was autumn on Laertes III. Soon, snow would be stinging down on an ever more barren land, and then winter would settle for eight long months. The original exploratory party had extracted from the flora and the fauna, and the soil and the rocks the cyclic secrets of the planet's existence. And in their two years stay they had mapped the gyrations of every wind, cold and heat source on its uneven surface.

Jamieson began to retreat. There were several defenses to rig up before night fell; and he had better hurry. An hour later, when the moonless darkness lay heavily over the mountain of mountains, Jamieson sat tensely before his visiplates.

It was going to be a long night for a man who dared not sleep.

It was shortly after midnight—Laertes III had a twenty-six hour, sidereal time, day—when Jamieson saw a movement at the remote perimeter of his all-wave vision plate. Finger on blaster control, he waited for the object to come into sharper focus.

It never did. The cold dawn found him weary but still alertly watching for an enemy that was acting as cautionsly as he himself.

He began to wonder if he had actually seen anything.

Jamieson took another antisleep pill and made a more definitive examination of the atomic motors. It didn't take long to verify his earlier diagnosis. The basic graviton pile had been thoroughly frustrated. Until it could be reactivated on the *Orion*, the motors were useless.

The conclusive examination braced Jamieson. He was com-

mitted irrevocably to the battle of the tableland, with all its intricate possibilities. The idea that had been turning over in his mind during the prolonged night took on new meaning. This was the first time in his knowledge that a Rull and a human being had faced each other on a limited field of action, where neither was a prisoner. The great battles in space were ship against ship and fleet against fleet. Survivors either escaped or were picked up by overwhelming forces. Actually, both humans and Rulls, captured or facing capture, were conditioned to kill themselves. Rulls did it by a mental *willing* that had never been circumvented. Men had to use mechanical methods, and in some cases that had proved impossible. The result was that Rulls had had occasional opportunities to experiment on living, conscious men.

Unless he was bested, before he could get organized, here was a priceless opportunity to try some tests on Rulls—and without delay. Every moment of daylight must be utilized to the uttermost limit.

Jamieson put on his special "defensive" belts, and went outside.

The dawn was brightening minute by minute; and the vistas that revealed themselves with each increment of light power held him, even as he tensed his body for the fight ahead. *Why*, he thought, in a sharp, excited wonder, *all this is happening on the strangest mountain ever known.*

Mount Monolith, discovered at the same time as the planet, two years before, had been named in the first words spoken about it. "Look at that monolith down there!" On a level plain that column stood, and reared up precipitously to a height of eight thousand two hundred feet. The most majestic pillar in the known universe, it easily qualified as one of the hundred natural wonders of the galaxy.

Standing there, Jamieson felt, not for the first time, the greatness of man's destiny. Defender and ally of thousands of life-forms, chief enemy of the encroaching Rull menace—In his eighteen years of military service he had gazed on many alien scenes. He had walked the soil of planets two hundred thousand light-years from Earth. As head of the fleet's science division, he had been absolute commander—under law and regulation—of ships so powerful that whole groups of inhabited worlds were helpless before their irresistible might—ships that flashed from the eternal night into the blazing brightness of suns red and suns blue, suns yellow and white and orange and violet, suns so wonderful and different that no previous imaginings could match the reality.

Yet, despite, the greatness of his rank, here he stood on a mountain on far Laertes, one man compelled by circumstance to pit his cunning against one or more of the supremely intelligent Rull enemy. The information about the discovery of the Laertes planet had been relayed to him through the usual routine channels. Instantly

he had seen what the others had missed, that it would be a key base against either galactic hemisphere. Since battleships did not normally carry the type of planetary oryctologist who could make a co-ordinated survey, he had not hesitated to step into the breach.

Even as it was, the first great advantage was already lost.

Jamieson shook himself grimly. It was time to launch his attack—and discover the opposition that could be mustered against him.

That was Step One, and the important point about it was to insure that it wasn't also Step Last.

By the time the Laertes sun peered palely over the horizon that was the northeast cliff's edge, the assault was under way. The automatic defensors, which he had set up the night before, moved slowly from point to point ahead of the mobile blaster.

Jamieson cautiously saw to it that one of the three defensors also brought up his rear. He augmented that basic protection by crawling from one projecting rock after another. The machines he manipulated from a tiny hand control, which was connected to the visiplates that poked out from his headgear just above his eyes. With tensed eyes, he watched the wavering needles that would indicate movement or that the defensor screens were being subjected to energy opposition.

Nothing happened.

As he came within sight of the Rull craft, Jamieson stalled his attack, while he seriously pondered the problem of no resistance. He didn't like it. It was possible that all the Rulls aboard had been killed, but he doubted it mightily. Rulls were almost boneless. Except for half a dozen strategically linked cartilages, they were all muscle.

With bleak eyes, Jamieson studied the wreck through the telescopic eyes of one of the defensors. It lay in a shallow indentation, its nose buried in a wall of gravel. Its lower plates were collapsed versions of the original. His single energy blast the evening before, completely automatic though it had been, had really dealt a smashing blow to the Rull ship.

The over-all effect was of utter lifelessness. If it was a trick, then it was a very skillful one. Fortunately, there were tests he could make, not absolutely final but evidential and indicative.

He made them.

The echoless height of the most unique mountain ever discovered hummed with the fire-sound of the mobile blaster. The noise grew to a roar as the unit's pile warmed to its task, and developed its maximum kilo curie activity.

Under that barrage, the hull of the enemy craft trembled a little and changed color slightly, but that was all. After ten minutes, Jamieson cut the power, and sat baffled and indecisive.

The defensive screens of the Rull ship were full on. Had they gone on automatically after his first shot of the evening before? Or had they been put up deliberately to nullify just such an attack as this?

He couldn't be sure. That was the trouble; he had no positive knowledge. The Rull could be lying inside dead. (Odd, how he was beginning to think in terms of one rather than several, but he had a conviction that two live Rulls would not be cautious in dealing with one human being—of course, they couldn't be absolutely sure there was only one.) It could be wounded and incapable of doing anything against him. It could have spent the night marking up the tableland with *elled* nerve control lines—he'd have to make sure he never looked directly at the ground—or it could simply be waiting for the arrival of the greater ship that had dropped it onto the planet.

Jamieson refused to consider the last possibility. That way was death, without qualification or hope.

Frowningly, he studied the visible damage he had done the ship. All the hard metals had held together, so far as he could see, but the whole bottom of the ship was dented to a depth that varied from one to four feet. Some radiation must have got in, and the question was, what would it have damaged?

He had examined dozens of captured Rull survey craft, and if this one ran to the pattern, then in the front would be the control center, with a sealed off blaster chamber. In the rear the engine room, two storerooms, one for fuel and equipment, the other for food and—

For food. Jamieson jumped, and then with wide eyes noted how the food section had suffered greater damage than any other part of the ship.

Surely, surely, some radiation must have got into it, poisoning it, ruining it, and instantly putting the Rull, with his swift digestive system, into a deadly position.

Jamieson sighed with the intensity of his hope, and prepared to retreat. As he turned away, quite incidentally, accidentally, he glanced at the rock behind which he had shielded himself from possible direct fire.

Glanced at it, and saw the *elled* lines in it. Intricate lines, based on a profound and inhuman study of the human nervous system. Jamieson recognized them, and stiffened in horror. He thought in anguish: *Where,* where *am I supposed to fall? Which cliff?*

With a desperate will, with all his strength, he fought to retain his senses a moment longer. He strove to see the lines again. He saw, briefly, flashingly, five vertical and above them three lines that pointed east with their wavering ends.

The pressure built up, up, up inside him, but still he fought to keep his thoughts moving. Fought to remember if there were any wide ledges near the top of the east cliff.

There were. He recalled them in a final agony of hope. *There,* he thought. *That one,* that *one, Let me fall on that one.* He strained to hold the ledge image he wanted, and to repeat, repeat the command that might save his life. His last, dreary thought was that here was

the answer to his doubts. The Rull *was* alive.

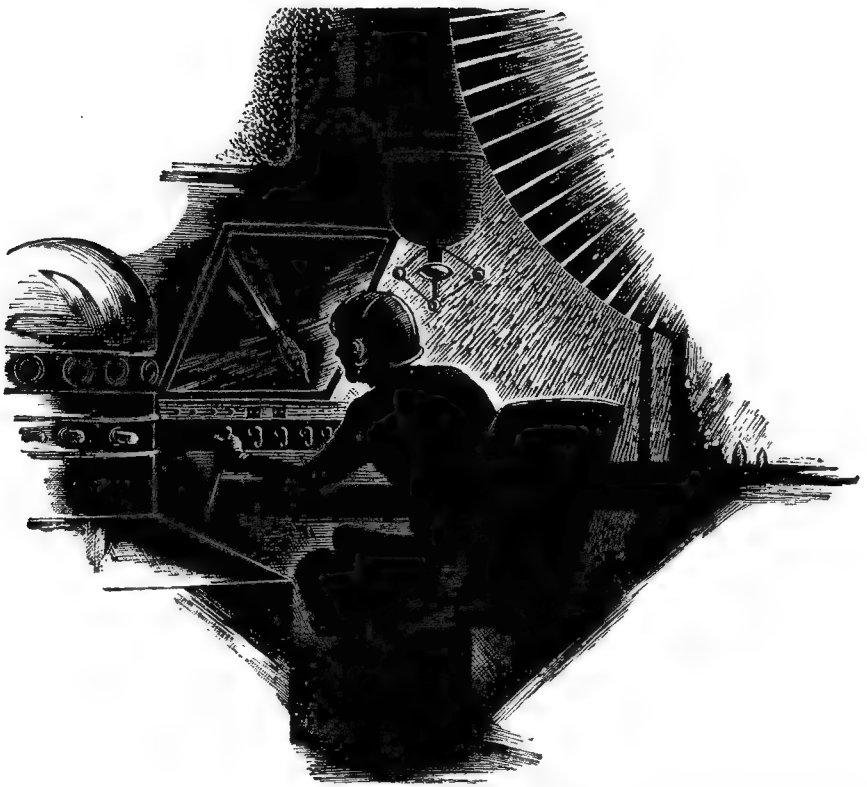
Blackness came like a curtain of pure essence of night.

From the far galaxy had he come, a cold, remorseless leader of leaders, the *yeli*, Meeesh, the Iiin of Ria, the high Aaish of the Yeell. And other titles, and other positions, and power. Oh, the power that he had, the power of death, the power of life and the power of the Leard ships.

He came in his great anger to discover what was wrong. A thousand years before the command had been given: Expand into the Second galaxy. Why were they-who-could-not-be-more-perfect so slow in carrying out these instructions? What was the nature of the two-legged creatures whose multitudinous ships, impregnable planetary bases and numerous allies had fought those-who-possessed-Nature's-supreme-nervous-system to an impasse?

"Bring me a live human being!" The command echoed to the ends of Riatic space.

It produced a dull survivor of an



Earth cruiser, a sailor of low degree with an I.Q. of ninety-six, and a fear index of two hundred and seven. The creature made vague efforts to kill himself, and squirmed on the laboratory tables, and finally escaped into death when the scientists were still in the beginning of the experiments which *he* had ordered to be performed before his own eyes.

"*Surely, this is not the enemy.*"

"Sire, we capture so few that are alive. Just as we have conditioned our own loved-ones, so do they seem to be conditioned to kill themselves in case of capture."

"The environment is wrong. We must create a situation where the captured does not know himself to be prisoner. Are there any possibilities?"

"The problem will be investigated."

He had come, as the one who will conduct the experiment, to the sun where a man had been observed seven periods before—"in a small craft that fell from a point in space, obviously dropped by a warship. And so we have a new base possibility.

"No landings have yet been made, as you instructed; no traces of our presence. It may be assumed that there was an earlier human landing on the third planet. A curious mountain top. Will be an ideal area for our purposes."

A battle group patrolled the space around the sun. But *he* came down in a small ship; and because he had contempt for his enemy, he flew in over the mountain, fired his disabling blast at the ship on the ground—and then was struck by a surprisingly potent return blast, that sent his machine spinning to a crash.

Almost, in those seconds, death came. But he crawled out of his control chair, shocked but still alive. With thoughtful eyes, he assessed the extent of the disaster that had befallen him.

He had issued commands that he would call when he needed help. But he could not call. The radio was shattered beyond repair. He had a strange, empty sensation when he discovered that his food was poisoned.

Swiftly, he stiffened to the necessities of the situation.

The experiment would go on, with one proviso. When the need for food became imperative, he would kill the man, and so survive until the commanders of the ships grew alarmed, and came down to see what had happened.

Part of the sunless period, he spent exploring the cliff's edge. Then he hovered on the perimeter of the man's defensor energies, studying the lifeboat, and pondering the possible actions the other might take against him.

Finally, with a tireless patience he examined the approaches to his own ship. At key points, he drew the lines that-could-seize-the-minds-of-men. There was satisfaction, shortly after the sun came up, in seeing the enemy "caught" and "compelled". The satisfaction had but one drawback.

He could not take the advantage of the situation that he wanted.

The difficulty was that the man's blaster had been left focused on his main air lock. It was not emitting energy, but the Rull did not doubt that it would fire automatically if the door opened.

What made the situation serious was that, when he tried the emergency exit, it was jammed.

It hadn't been. With the forethought of his kind, he had tested it immediately after the crash. Then it opened.

Now, it didn't. The ship, he decided, must have settled while he was out during the sunless period. Actually, the reason for what had happened didn't matter. What counted was that he was locked in just when he wanted to be outside.

It wasn't as if he had definitely decided to destroy the man immediately. If capturing him meant gaining control of his food supply, then it would be unnecessary to give him death. It was important to be able to make the decision, however, while the man was helpless; and the further possibility that the *elled* fall might kill him made the *yeli* grim. He didn't like accidents to disturb his plans.

From the beginning the affair had taken a sinister turn. He had been caught up by forces beyond his control, by elements of space and time which he had always taken into account as being theoretically possible, but he had never considered them as having personal application.

That was for the deeps of space where the Leard ships fought to extend the frontiers of the perfect ones. Out there lived alien creatures that had been spawned by Nature before the ultimate nervous system was achieved. All those aliens must die because they were now unnecessary, and because, existing, they might accidently discover means of upsetting the balance of Yeellian life. In civilized Ria accidents were forbidden.

The Rull drew his mind clear of such weakening thoughts.

He decided against trying to open the emergency door. Instead, he turned his blaster against a crack in the hard floor. The frustrators blew their gases across the area where he had worked, and the suction pumps caught the swirling radioactive stuff and drew it into a special chamber. But the lack of an open door as a safety valve made the work dangerous. Many times he paused while the air was cleansed, and the counter needles shook themselves toward zero, so that he could come out again from the frustrating chamber to which he retreated whenever the heat made his nerves tingle—a more reliable guide than any instrument that had to be watched.

The sun was past the meridian when the metal plate finally lifted clear, and gave him an opening into the gravel and rock underneath. The problem of tunneling out into the open was easy except that it took time and physical effort. Dusty and angry and hungry, the Rull emerged from the hole near the center of the clump of trees beside which his craft had fallen.

His plan to conduct an experiment had lost its attraction. He had obstinate qualities in his nature, but he reasoned that this situation could be reproduced for him on a more civilized level. No need to take risks or to be uncomfortable. Kill the man and use him as food until the ships came down to rescue him.

With hungry gaze, he searched the ragged, uneven east cliff, peering down at the ledges, crawling swiftly along until he had virtually circumvented the tableland. He found nothing he could be sure about. In one or two places the ground looked lacerated as by the passage of a body, but the most intensive examination failed to establish that anyone had actually been there.

Somberly, the Rull glided towards the man's lifeboat. From a safe distance, he examined it. The defense screens were up, but he couldn't be sure they had been put up before the attack of the morning, or had been raised since then, or had come on automatically at his approach.

He couldn't be sure. That was the trouble. Everywhere, on the tableland around him, was a barrenness, a desolation unlike anything else he had ever known. The man could be dead, his smashed body lying at the remote bottom of the mountain. He could be inside the ship badly injured; he had, unfortunately, *had* time to get back to the safety of his craft. Or he could be waiting inside, alert, aggressive, and conscious of his enemy's uncertainty, determined to take full advantage of that uncertainty.

The Rull set up a watching device, that would apprise him when the door opened. Then he returned to the tunnel that led into his ship, laboriously crawled through it, and settled himself to wait out the emergency.

The hunger in him was an expanding force, hourly taking on a greater urgency. It was time to stop moving around. He would need all his energy for the crisis.

The days passed.

Jamieson stirred in an effluvium of pain. At first it seemed all-enveloping, a mist of anguish that bathed him in sweat from head to toe. Gradually, then, it localized in the region of his lower left leg.

The pulse of the pain made a rhythm in his nerves. The minutes lengthened into an hour, and then he finally thought: *Why, I've got a sprained ankle!* He had more than that, of course. The pressure that had driven him here clung like a gravitonic plate. How long he lay there, partly conscious, was not clear, but when he finally opened his eyes, the sun was still shining on him, though it was almost directly overhead.

He watched it with the mindlessness of a dreamer as it withdrew slowly past the edge of the overhanging precipice. It was not until the shadow of the cliff suddenly plopped across his face that he started to full consciousness with a sudden memory of deadly danger.

It took a while to shake the remnants of the *elled* "take" from his brain. And, even as it was fading, he sized up, to some extent, the difficulties of his position. He saw that he had tumbled over the edge of a cliff to a steep slope. The angle of descent of the slope was a sharp fifty-five degrees, and what had saved him was that his body had been caught in the tangled growth near the edge of the greater precipice beyond.

His foot must have twisted in those roots, and sprained.

As he finally realized the nature of his injuries, Jamieson braced up. He was safe. In spite of having suffered an accidental defeat of major proportions, his intense concentration on this slope, his desperate will to make *this* the place where he must fall, had worked out.

He began to climb. It was easy enough on the slope, steep as it was; the ground was rough, rocky and scraggly with brush. It was when he came to the ten-foot overhanging cliff that his ankle proved what an obstacle it could be.

Four times he slid back, reluctantly; and then, on the fifth try, his fingers, groping desperately over the top of the cliff, caught an unbreakable root. Triumphantly, he dragged himself to the safety of the tableland.

Now that the sound of his scraping and struggling was gone, only his heavy breathing broke the silence of the emptiness. His anxious eyes studied the uneven terrain. The tableland spread before him with not a sign of a moving figure anywhere.

To one side, he could see his lifeboat. Jamieson began to crawl toward it, taking care to stay on rock as much as possible. What had happened to the Rull he did not know. And since, for several days, his ankle would keep him inside his ship, he might as well keep his enemy guessing during that time.

Professor Jamieson lay in his bunk, thinking. He could hear the beating of his heart. There were the occasional sounds when he dragged himself out of bed. But that was almost all. The radio, when he turned it on, was dead. No static, not even the fading in and out of a wave. At this colossal distance, even subspace radio was impossible.

He listened on all the more active Rull wave lengths. But the silence was there, too. Not that they would be broadcasting if they were in the vicinity.

He was cut off here in this tiny ship on an uninhabited planet, with useless motors.

He tried not to think of it like that. "Here," he told himself, "is the opportunity of a lifetime for an experiment."

He warmed to the idea as a moth to flame. Live Rulls were hard to get hold of. About one a year was captured in the unconscious state, and these were regarded as priceless treasures. But here was an even more ideal situation.

We're prisoners, both of us. That

was the way he tried to picture it. Prisoners of an environment, and, therefore, in a curious fashion, prisoners of each other. Only each was free of the conditioned need to kill himself.

There were things a man might discover. The great mysteries—as far as men were concerned—that motivated Rull actions. Why did they want to destroy other races totally? Why did they needlessly sacrifice valuable ships in attacking Earth machines that ventured into their sectors of space—when they knew that the intruders would leave in a few weeks anyway? And why did prisoners who could kill themselves at will commit suicide without waiting to find out what fate was intended for them? Some times they were merely wanted as messengers.

Was it possible the Rulls were trying to conceal a terrible weakness in their make-up of which man had not yet found an inkling?

The potentialities of this fight of man against Rull on a lonely mountain exhilarated Jamieson as he lay on his bunk, scheming, turning the problem over in his mind.

There were times during those dog days when he crawled over to the control chair, and peered for an hour at a stretch into the visiplates. He saw the tableland and the vista of distance beyond it. He saw the sky of Laertes III, bluish pink sky, silent and lifeless.

He saw the prison. Caught here, he thought bleakly. Professor Jamieson, whose appearance on an inhabited planet would bring out unwieldy crowds, whose quiet voice in the council chambers of Earth's galactic empire spoke with final authority—that Jamieson was here, alone, lying in a bunk, waiting for a leg to heal, so that he might conduct an experiment with a Rull.

It seemed incredible. But he grew to believe it as the days passed.

On the third day, he was able to move around sufficiently to handle a few heavy objects. He began work immediately on the mental screen. On the fifth day it was finished. Then the story had to be recorded. That was easy. Each sequence had been so carefully worked out in bed that it flowed from his mind onto the visiwire.

He set it up about two hundred yards from the lifeboat, behind a screening of trees. He tossed a can of food a dozen feet to one side of the screen.

The rest of the day dragged. It was the sixth day since the arrival of the Rull, the fifth since he had sprained his ankle.

Came the night.

A gliding shadow, undulating under the starlight of Laertes III, the Rull approached the screen the man had set up. How bright it was, shining in the darkness of the tableland, a blob of light in a black universe of uneven ground and dwarf shrubbery.

When he was a hundred feet from the light, he sensed the food—and realized that here was a trap.

For the Rull, six days without food had meant a stupendous loss

of energy, visual blackouts on a dozen color levels, a dimness of life-force that fitted with the shadows, not the sun. That inner world of disjointed nervous system was like a run-down battery, with a score of organic "instruments" disconnecting one by one as the energy level fell. The *ych* recognized dimly, but with a savage anxiety, that only a part of that nervous system would ever be restored to complete usage. And, even for that, speed was essential. A few more steps downward, and then the old, old conditioning of mandatory self-inflicted death would apply even to the high Aaish of the Yeell.

The worm body grew quiet. The visual center behind each eye accepted light on a narrow band from the screen. From beginning to end, he watched the story as it unfolded, and then watched it again, craving repetition with all the ardor of a primitive.

The picture began in deep space with the man's lifeboat being dropped from a launching lock of a battleship. It showed the battleship going on to a military base, and there taking on supplies and acquiring a vast fleet of reinforcements, and then starting on the return journey. The scene switched to the lifeboat dropping down on Laertes III, showed everything that had subsequently happened, suggested the situation was dangerous to them both—and pointed out the only safe solution.

The final sequence of each showing of the story was of the Rull approaching the can, to the left of the screen, and opening it. The method was shown in detail, as was the visualization of the Rull busily eating the food inside.

Each time that sequence drew near, a tenseness came over the Rull, a will to make the story real. But it was not until the seventh showing had run its course that he glided forward, closing the last gap between himself and the can. It was a trap, he knew, perhaps even death—it didn't matter. To live, he had to take the chance. Only by this means, by risking what was in the can, could he hope to remain alive for the necessary time.

How long it would take for the commanders cruising up there in the black of space in their myriad ships—how long it would be before they would decide to supersede his command, he didn't know. But they would come. Even if they waited until the enemy ships arrived before they dared to act against his strict orders, they would come.

At that point they could come down without fear of suffering from his ire.

Until then he would need all the food he could get.

Gingerly, he extended a sucker, and activated the automatic opener of the can.

It was shortly after four in the morning when Professor Jamieson awakened to the sound of an alarm ringing softly. It was still pitch dark outside—the Laertes day was twenty-six sidereal hours long; he had set his clocks the first day to

co-ordinate—and at this season dawn was still three hours away.

Jamieson did not get up at once. The alarm had been activated by the opening of the can of food. It continued to ring for a full fifteen minutes, which was just about perfect. The alarm was tuned to the electronic pattern emitted by the can, once it was opened, and so long as any food remained in it. The lapse of time involved fitted with the capacity of one of the Rull's suckers in absorbing three pounds of pork.

For fifteen minutes, accordingly, a member of the Rull race, man's mortal enemy, had been subjected to a pattern of mental vibrations corresponding to its own thoughts. It was a pattern to which the nervous systems of other Rulls had responded in laboratory experiments. Unfortunately, those others had killed themselves on awakening, and so no definite results had been proved. But it had been established by the ecphoriometer that the "unconscious" and not the "conscious" mind was affected.

Jamieson lay in bed, smiling quietly to himself. He turned over finally to go back to sleep, and then he realized how excited he was.

The greatest moment in the history of Rull-human warfare. Surely, he wasn't going to let it pass unremarked. He climbed out of bed, and poured himself a drink.

The attempt of the Rull to attack him through his unconscious mind had emphasized his own possible actions in that direction. Each race had discovered some of the weaknesses of the other.

Rulls used their knowledge to exterminate. Man tried for communication, and hoped for association. Both were ruthless, murderous, pitiless, in their methods. Outsiders sometimes had difficulty distinguishing one from the other.

But the difference in purpose was as great as the difference between black and white, the absence as compared to the presence of light.

There was only one trouble with the immediate situation. Now, that the Rull had food, he might develop a few plans of his own.

Jamieson returned to bed, and lay staring into the darkness. He did not underrate the resources of the Rull, but since he had decided to conduct an experiment, no chance must be considered too great.

He turned over finally, and slept the sleep of a man determined that things were working in his favor.

Morning. Jamieson put on his cold-proof clothes, and went out into the chilly dawn. Again, he savored the silence and the atmosphere of isolated grandeur. A strong wind was blowing from the east, and there was an iciness in it that stung his face. Snow? He wondered.

He forgot that. He had things to do on this morning of mornings. He would do them with his usual caution.

Paced by defensors and the mobile blaster, he headed for the mental screen. It stood in open high ground, where it would be visible from a dozen different hiding places, and so far as he could see it was undamaged. He tested the automatic mechanism, and for good measure ran the picture through one showing.

He had already tossed another can of food in the grass near the screen, and he was turning away when he thought: *That's odd. The metal framework looks as if it's been polished.*

He studied the phenomena in a de-energizing mirror, and saw that the metal had been varnished with a clear, varnishlike substance. He felt sick as he recognized it.

He decided in agony, *If the cue is not to fire at all, I won't do it. I'll fire even if the blaster turns on me.*

He scraped some of the "varnish" into a receptacle, and began his retreat to the lifeboat. He was thinking violently:

Where does he get all this stuff? That isn't part of the equipment of a survey craft.

The first deadly suspicion was on him, that what was happening was not just an accident. He was pondering the vast implications of that, narrow-eyed, when, off to one side, he saw the Rull.

For the first time, in his many

days on the tableland, he saw the Rull.

What's the cue!

Memory of purpose came to the Rull shortly after he had eaten. It was dim at first, but it grew stronger.

It was not the only sensation of his returning energy.

His visual centers interpreted more light. The starlit tableland grew brighter, not as bright as it could be for him, by a very large percentage but the direction was up instead of down. It would never again be normal. Vision was in the mind, and that part of his mind no longer had the power of interpretation.

He felt unutterably fortunate that it was no worse.

He had been gliding along the edge of the precipice. Now, he paused to peer down. Even with his partial night vision, the view was breathtaking. There was distance below and distance afar. From a spaceship, the height was almost minimum. But gazing down that wall of gravel into those depths was a different experience. It emphasized how completely he had been caught by an accident. And it reminded him of what he had been doing before the hunger.

He turned instantly away from the cliff, and hurried to where the wreckage of his ship had gathered dust for days. Bent and twisted wreckage, half-buried in the hard ground of Laertes III. He glided over the dented plates inside to one in which he had the day before sensed a quiver of antigravity oscillation. Tiny, potent, tremendous minutiae of oscillation, capable of being influenced.

The Rull worked with intensity and purposefulness. The plate was still firmly attached to the frame of the ship. And the first job, the heartbreakingly difficult job was to tear it completely free. The hours passed.

R-r-i-i-i-pp! The hard plate yielded to the slight rearrangement of its nucleonic structure. The shift was infinitesimal, partly because the directing nervous energy of his body was not at norm, and partly because it had better be infinitesimal. There was such a thing as releasing energy enough to blow up a mountain.

Not, he discovered finally, that there was danger in this plate. He found that out the moment he crawled onto it. The sensation of power that aura-ed out of it was so dim that, briefly, he doubted if it would lift from the ground.

But it did. The test run lasted seven feet, and gave him his measurement of the limited force he had available. Enough for an attack only.

He had no doubts in his mind. The experiment was over. His only purpose must be to kill the man, and the question was, how could he insure that the man did not kill him while he was doing it? The varnish!

He applied it painstakingly, dried it with a drier, and then, picking up the plate again, he carried it on his back to the hiding place he wanted.

When he had buried it and himself under the dead leaves of a clump of brush, he grew calmer. He recognized that the veneer of his civilization was off. It shocked him, but he did not regret it.

In giving him the food, the two-legged being was obviously doing something to him. Something dangerous. The only answer to the entire problem of the experiment of the tableland was to deal death without delay.

He lay tense, ferocious, beyond the power of any vagrant thoughts, waiting for the man to come.

It looked as desperate a venture as Jamieson had seen in Service. Normally, he would have handled it effortlessly. But he was watching intently—*intently*—for the paralysis to strike him, the negation that was of the varnish.

And so, it was the unexpected normal quality that nearly ruined him. The Rull flew out of a clump of trees mounted on an antigravity plate. The surprise of that was so great that it almost succeeded. The plates had been drained of all such energies, according to his tests the first morning. Yet here was one alive again and light again with the special antigravity lightness which Rull scientists had brought to the peak of perfection.

The action of movement through space toward him was, of course, based on the motion of the planet as it turned on its axis. The speed of the attack, starting as it did from zero, did not come near the eight hundred mile an hour velocity of the spinning planet, but it was swift enough.

The apparition of metal and six-foot worm charged at him through the air. And even as he drew his weapon and fired at it, he had a choice to make, a restraint to exercise: *Do not kill!*

That was hard, oh, hard. The necessity exercised his capacity for integration and imposed so stern a limitation that during the second it took him to adjust the Rull came to within ten feet of him.

What saved him was the pressure of the air on the metal plate. The air tilted it like a wing of a plane becoming airborne. At the bottom of that metal he fired his irresistible weapon, seared it, burned it, deflected it to a crash landing in a clump of bushes twenty feet to his right.

Jamieson was deliberately slow in following up his success. When he reached the bushes, the Rull was fifty feet beyond it gliding on its multiple suckers over the top of a hillock. It disappeared into a clump of trees.

He did not pursue it or fire a second time. Instead, he gingerly pulled the Rull antigravity plate out of the brush and examined it. The question was, how had the Rull de-gravitized it without the elaborate machinery necessary? And if it was capable of creating such a "parachute" for itself why hadn't it floated down to the forest land far below where food would be available and where it would be safe from its human enemy?

One question was answered the

moment he lifted the plate. It was "normal" weight, its energy apparently exhausted after traveling less than a hundred feet. It had obviously never been capable of making the mile and a half trip to the forest and plain below.

Jamieson took no chances. He dropped the plate over the nearest precipice, and watched it fall into distance. He was back in the lifeboat, when he remembered the "varnish".

Why, there had been no cue, not yet.

He tested the scraping he had brought with him. Chemically, it turned out to be a simple resin, used to make varnishes. Atomically, it was stabilized. Electronically, it transformed light into energy on the vibration level of human thought.

It was alive all right. But what was the recording?

Jamieson made a graph of every material and energy level, for comparison purposes. As soon as he had established that it had been altered on the electronic level—which had been obvious, but which, still, had to be proved—he recorded the images on a visiwire. The result was a hodgepodge of dreamlike fantasies.

Symbols. He took down his book, "Symbol Interpretations of the Unconscious," and found the cross reference: "Inhibitions, Mental."

On the referred page and line, he read: "Do not kill!"

"Well, I'll be—" Jamieson said aloud into the silence of the lifeboat interior. "That's what happened."

He was relieved, and then not so relieved. It had been his personal intention not to kill at this stage. But the Rull hadn't known that. By working such a subtle inhibition, it had dominated the attack even in defeat.

That was the trouble. So far he had got *out* of situations, but had created no successful ones in retaliation. He had a hope but that wasn't enough.

He must take no more risks. Even his final experiment must wait until the day the *Orion* was due to arrive.

Human beings were just a little too weak in certain directions. Their very life cells had impulses which could be stirred by the cunning and the remorseless.

He did not doubt that, in the final issue, the Rull would try to stir.

On the ninth night, the day before the *Orion* was due, Jamieson refrained from putting out a can of food. The following morning he spent half an hour at the radio, trying to contact the battleship. He made a point of broadcasting a detailed account of what had happened so far, and he described what his plans were, including his intention of testing the Rull to see if it had suffered any injury from its period of hunger.

Subspace was as silent as death. Not a single pulse of vibration answered his call.

He finally abandoned the attempt to establish contact, and went out-

side. Swiftly, he set up the instruments he would need for his experiment. The tableland had the air of a deserted wilderness. He tested his equipment, then looked at his watch. It showed eleven minutes of noon. Suddenly jittery, he decided not to wait the extra minutes.

He walked over, hesitated, and then pressed a button. From a source near the screen, a rhythm on a very high energy level was being broadcast. It was a variation of the rhythm pattern to which the Rull had been subjected for four nights.

Slowly, Jamieson retreated toward the lifeboat. He wanted to try again to contact the *Orion*. Looking back, he saw the Rull glide into the clearing, and head straight for the source of the vibration.

As Jamieson paused involuntarily, fascinated, the main alarm system of the lifeboat went off with a roar. The sound echoed with an alien eeriness on the wings of the icy wind that was blowing, and it acted like a cue. His wrist radio snapped on, synchronizing automatically with the powerful radio in the lifeboat. A voice said urgently:

"Professor Jamieson, this is the battleship *Orion*. We heard your earlier calls but refrained from answering. An entire Rull fleet is cruising in the vicinity of the Laertes sun.

"In approximately five minutes, an attempt will be made to pick you up. Meanwhile—*drop everything.*"

Jamieson dropped. It was a physical movement, not a mental one. Out of the corner of one eye, even as he heard his own radio, he saw a movement in the sky. Two dark blobs, that resolved into vast shapes. There was a roar as the Rull super-battleships flashed by overhead. A cyclone followed their passage, that nearly tore him from the ground, where he clung desperately to the roots of intertwining brush.

At top speed, obviously traveling under gravitonic power, the enemy warships turned a sharp somersault, and came back toward the tableland. Expecting death, and beginning to realize some of the truth of the situation on the tableland, Jamieson quailed. But the fire flashed past him, not at him. The thunder of the shot rolled toward Jamieson, a colossal sound, that yet did not blot out his sense awareness of what had happened. His lifeboat. They had fired at his lifeboat.

He groaned as he pictured it destroyed in one burst of intolerable flame. And then, for a moment, there was no time for thought or anguish.

A third warship came into view, but, as Jamieson strained to make out its contours, it turned and fled. His wrist radio clicked on:

"Cannot help you now. Save yourself. Our four accompanying battleships and attendant squadrons will engage the Rull fleet, and try to draw them toward our great battle group cruising near the star, Bianca, and then re—"

A flash of vivid fire in the distant sky ended the message. It was a full minute before the cold air of Laertes III echoed to the remote thunder of the broadside. The sound died slowly, reluctantly, as if endless little overtones of it were clinging to each molecule of air.

The silence that settled finally was, strangely, not peaceful. But like the calm before a storm, a fateful, quiescent stillness, alive with unmeasurable threat.

Shakily, Jamieson climbed to his feet. It was time to assess the immediate danger that had befallen him. The greater danger he dared not even think about.

Jamieson headed first for his lifeboat. He didn't have to go all the way. The entire section of the cliff had been sheared away. Of the ship there was no sign.

It pulled him up short. He had expected it, but the shock of the reality was terrific.

He crouched like an animal, and stared up into the sky, into the menacing limits of the sky. It was empty of machines. Not a movement was there, not a sound came out of it, except the sound of the east wind. He was alone in a universe between heaven and earth, a mind poised at the edge of an abyss.

Into his mind, tensely waiting, pierced a sharp understanding. The Rull ships had flown once over the mountain to size up the situation on the tableland, and then had tried to destroy him.

Who was the Rull here with him, that super-battleships should roar down to insure that no danger remained for it on the tableland?

Well, they hadn't quite succeeded. Jamieson showed his teeth into the wind. Not quite. But he'd have to hurry. At any moment, they might risk one of their destroyers in a rescue landing.

As he ran, he felt himself one with the wind. He knew that feeling, that sense of returning primitiveness during moments of excitement. It was like that in battles, and the important thing was to yield one's whole body and soul to it. There was no such thing as fighting efficiently with half your mind or half your body. All, all, was demanded.

He expected falls, and he had them. Each time he got up, almost unconscious of the pain, and ran on again. He arrived bleeding—but he arrived.

The sky was silent.

From the shelter of a line of brush, he peered at the Rull.

The captive Rull, *his* Rull to do with as he pleased. To watch, to force, to educate—the fastest education in the history of the world. There wasn't any time for a leisurely exchange of information.

From where he lay, he manipulated the controls of the screen.

The Rull had been moving back and forth in front of the screen. Now, it speeded up, then slowed, then speeded up again, according to his will.

Some thousands of years before, in the Twentieth Century, the clas-

sic and timeless investigation had been made of which this was one end result. A man called Pavlov fed a laboratory dog at regular intervals, to the accompaniment of the ringing of a bell. Soon, the dog's digestive system responded as readily to the ringing of the bell without the food as to the food and the bell together.

Pavlov himself never did realize the most important reality behind his conditioning process. But what began on that remote day ended with a science that could control animals and aliens—and men—almost at will. Only the Rulls baffled the master experimenters in the later centuries when it was an exact science. Defeated by the will to death of all Rull captives, the scientists foresaw the doom of Earth's galactic empire unless some beginning could be made in penetrating the minds of Rulls.

It was his desperate bad luck that he had no time for real penetrations.

There was death here for those who lingered.

But even what he had to do, the bare minimum of what he had to do, would take precious time. Back and forth, back and forth; the

rhythm of obedience had to be established.

The image of the Rull on the screen was as lifelike as the original. It was three dimensional, and its movements were like an automaton. The challenger was actually irresistible. Basic nerve centers were affected. The Rull could no more help falling into step than it could resist the call of the food impulse.

After it had followed that mindless pattern for fifteen minutes, changing pace at his direction, Jamieson started the Rull and its image climbing trees. Up, then down again, half a dozen times. At that point, Jamieson introduced an image of himself.

Tensely, with one eye on the sky and one on the scene before him, he watched the reactions of the Rull—watched them with narrowed eyes and a sharp understanding of Rull responses to the presence of human beings. Rulls were digestively stimulated by the odor of man. It showed in the way their suckers opened and closed. When a few minutes later, he substituted himself for his image, he was satisfied that this Rull had temporarily lost its normal automatic hunger when it saw a human being.

And now that he had reached the stage of final control, he hesitated. It was time to make his tests. Could he afford the time?

He realized that he had to. This opportunity might not occur again in a hundred years.

When he finished the tests twenty-five minutes later, he was pale with excitement. He thought: *This is it. We've got it.*

He spent ten precious minutes broadcasting his discovery by means of his wrist radio—hoping that the transmitter on his lifeboat had survived its fall down the mountain, and was picking up the thready message of the smaller instrument, and sending it out through subspace.

During the entire ten minutes, there was not a single answer to his call.

Aware that he had done what he could, Jamieson headed for the cliff's edge he had selected as a starting point. He looked down, and shuddered, then remembered what the *Orion* had said: "An entire Rull fleet cruising—"

Hurry!

He lowered the Rull to the first ledge. A moment later he fastened the harness around his own body, and stepped into space. Sedately, with easy strength, the Rull gripped the other end of the rope, and lowered him down to the ledge beside it.

They continued on down and down. It was hard work although they used a very simple system.

A long plastic "rope" spanned the spaces for them. A metal "climbing" rod, used to scale the smooth vastness of a spaceship's side, held position after position while the rope did its work.

On each ledge, Jamieson burned the rod at a downward slant into solid rock. The rope slid through an arrangement of pulleys in the

metal as the Rull and he, in turn, lowered each other to ledges farther down.

The moment they were both safely in the clear of one ledge, Jamieson would explode the rod out of the rock, and it would drop down ready for use again.

The day sank towards darkness like a restless man into sleep, slowly, wearily. Jamieson grew hot and tired, and filled with the melancholy of the fatigue that dragged at his muscles.

He could see that the Rull was growing more aware of him. It still co-operated, but it watched him with intent eyes each time it swung him down.

The conditioned state was ending. The Rull was emerging from its trance. The process should complete before night.

There was a time, then, when Jamieson despaired of ever getting down before the shadows fell. He had chosen the western, sunny side for that fantastic descent down a black-brown cliff the like of which did not exist elsewhere in the known worlds of space. He found himself watching the Rull with quick, nervous glances. When it swung him down onto a ledge beside it, he watched its blue eyes, its staring blue eyes, come closer and closer to him, and then as his legs swung below the level of those strange eyes, they twisted to follow him.

The intent eyes of the other reminded Jamieson of his discovery. He felt a fury at himself that he had never reasoned it out before. For centuries man had known that his own effort to see clearly required a good twenty-five per cent of the energy of his whole body. Human scientists should have guessed that the vast wave compass of Rull eyes was the product of a balancing of glandular activity on a fantastically high energy level. A balancing which, if disturbed, would surely affect the mind itself either temporarily or permanently.

He had discovered that the impairment was permanent.

What would a prolonged period of starvation diet do to such a nervous system?

The possibilities altered the nature of the war. It explained why Rull ships had never attacked human food sources or supply lines; they didn't want to risk retaliation. It explained why Rull ships fought so remorselessly against Earth ships that intruded into their sectors of the galaxy. It explained their ruthless destruction of other races. They lived in terror that their terrible weakness would be found out.

Jamieson smiled with a savage anticipation. If his message had got through, or if he escaped. Rulls would soon feel the pinch of hunger. Earth ships would concentrate on that one basic form of attack in the future. The food supplies of entire planetary groups would be poisoned, convoys would be raided without regard for casualties. Everywhere at once the attack would be pressed without let-up and without mercy.

It shouldn't be long before the Rull began his retreat to his own galaxy. That was the only solution that would be acceptable. The

invader must be driven back and back, forced to give up his conquests of a thousand years.

4:00 p.m. Jamieson had to pause again for a rest. He walked to the side of the ledge away from the Rull, and sank down on the rock. The sky was a brassy blue, silent and windless now, a curtain drawn across the black space above, concealing what must already be the greatest Rull-human battle in ten years.

It was a tribute to the five Earth battleships and their escort that no Rull ship had yet attempted to rescue the Rull on the tableland.

Possibly, of course, they didn't want to give away the presence of one of their own kind.

Jamieson gave up the futile speculation. Wearily, he compared the height of the cliff above with the depth that remained below. He estimated they had come two-thirds of the distance. He saw that the Rull was staring out over the valley. Jamieson turned and gazed with it.

The scene which they took in with their different eyes and different brains was fairly drab and very familiar, yet withal strange and wonderful. The forest began a quarter of a mile from the bottom of the cliff, and it almost literally had no end. It rolled up over the hills and down into the shallow valleys. It faltered at the edge of a broad river, then billowed out again, and climbed the slopes of mountains that sprawled mistily in distance.

His watch showed 4:15. Time to get going again.

At twenty-five minutes after six, they reached a ledge a hundred and fifty feet above the uneven plain. The distance strained the capacity of the rope, but the initial operation of lowering the Rull to freedom and safety was achieved without incident. Jamieson gazed down curiously at the worm. What would it do now that it was in the clear?

It looked up at him and waited.

That made him grim. Because this was a chance he was not taking. Jamieson waved imperatively at the Rull, and took out his blaster. The Rull backed away, but only into the safety of a gigantic rock. Blood-red, the sun was sinking behind the mountains. Darkness moved over the land. Jamieson ate his dinner. It was as he was finishing it that he saw a movement below.

He watched, as the Rull glided along close to the edge of the precipice.

It disappeared beyond an outjut of the cliff.

Jamieson waited briefly, then swung out on the rope. The descent drained his strength, but there was solid ground at the bottom. Three quarters of the way down, he cut his finger on a section of the rope that was unexpectedly rough.

When he reached the ground, he noticed that his finger was turning an odd gray. In the dimness, it looked strange and unhealthy.

As Jamieson stared at it, the color drained from his face. He thought in a bitter anger: *The Rull*

must have smeared it on the rope on his way down.

A pang went through his body. It was knife sharp, and it was followed instantly by a stiffness. With a gasp, he grabbed at his blaster, to kill himself. His hand froze in midair. He fell to the ground. The stiffness held him there, froze him there, moveless.

The will to death is in all life. Every organic cell ecphorizes the inherited engrams of its inorganic origin. The pulse of life is a squamous film superimposed on an underlying matter so intricate in its delicate balancing of different energies that life itself is but a brief, vain straining against that balance.

For an instant of eternity, a pattern is attempted. It takes many forms, but these are apparent. The real shape is always a time and not a space shape. And that shape is a curve. Up and then down. Up from the darkness into the light, then down again into the blackness.

The male salmon sprays his mist of milt onto the eggs of the female. And instantly he is seized with a mortal melancholy. The male bee collapses from the embrace of the queen he has won, back into that inorganic mold from which he climbed for one single moment of ecstasy. In man, the fateful pattern is repressed into quadrillions of individual cells.

But the pattern is there. Waiting.

Long before, the sharp-minded Rull scientists, probing for chemical substances that would shock man's system into its primitive forms, found the special secret of man's will to death.

The *yeli*, Meeesh, gliding back towards Jamieson did not think of the process. He had been waiting for the opportunity. It had occurred. He was intent on his own purposes.

Briskly, he removed the man's blaster, then he searched for the key to the lifeboat. And then he carried Jamieson a quarter of a mile around the base of the cliff to where the man's ship had been catapulted by the blast from the Rull warship.

Five minutes later, the powerful radio inside was broadcasting on Rull wave lengths, an imperative command to the Rull fleet.

Dimness. Inside and outside his skin. He felt himself at the bottom of a well, peering out of night into twilight. As he lay, a pressure of something swelled around him, lifted him higher and higher, and nearer to the mouth of the well.

He struggled the last few feet, a distinct mental effort, and looked over the edge. Consciousness.

He was lying on a raised table inside a room which had several large mouselike openings at the floor level, openings that led to other chambers. Doors, he identified, odd-shaped, alien, unhuman. Jamieson cringed with the stunning shock of recognition.

He was inside a Rull warship.

There was a slithering of movement behind him. He turned his head, and rolled his eyes in their sockets.

In the shadows, three Rulls were

gliding across the floor towards a bank of instruments that reared up behind and to one side of him. They pirouetted up an inclined plane and poised above him. Their pale eyes, shiny in the dusk of that unnatural chamber, peered down at him.

Jamieson tried to move. His body writhed in the confines of the bonds that held him. That brought a sharp remembrance of the death-will chemical that the Rull had used. Relief came surging. He was not dead. *Not dead.* NOT DEAD. The Rull must have helped him, forced him to move, and so had broken the downward curve of his descent to dust.

He was alive—for what?

The thought slowed his joy. His hope snuffed out like a flame. His brain froze into a tensed, terrible mask of anticipation.

As he watched with staring eyes, expecting pain, one of the Rulls pressed a button. Part of the table on which Jamieson was lying, lifted. He was raised to a sitting position.

What now?

He couldn't see the Rulls. He tried to turn, but two head shields clamped into the side of his head, and held him firmly.

He saw that there was a square of silvery sheen on the wall which he faced. A light sprang onto it, and then a picture. It was a curiously familiar picture, but at first because there was a reversal of position Jamieson couldn't place the familiarity.

Abruptly, he realized.

It was a twisted version of the picture that he had shown the Rull, first when he was feeding it, and then with more weighty arguments after he discovered the vulnerability of man's mortal enemy.

He had shown how the Rull race would be destroyed unless it agreed to peace.

In the picture he was being shown it was the Rull that urged co-operation between the two races. They seemed unaware that he had not yet definitely transmitted his knowledge to other human beings. Or perhaps that fact was blurred by the conditioning he had given to the Rull when he fed it and controlled it.

As he glared at the screen, the picture ended—and then started again. By the time it had finished a second time, there was no doubt. Jamieson collapsed back against the table. They would not show him such a picture unless he was to be used as a messenger.

He would be returned home to carry the message that man had wanted to hear for a thousand years. He would also carry the information that would give meaning to the offer.

The Rull-human war was over.

THE END.

THE STRANGE CASE OF JOHN KINGMAN

BY MURRAY LEINSTER

***The** odd patient had been around the asylum a long time. That time was, in fact, one of the oddest things about him—*

Illustrated by Cartier

It started when Dr. Braden took the trouble to look up John Kingman's case-history card. Meadeville Mental Hospital had a beautifully elaborate system of card-indexes, because psychiatric research is stressed there. It is the oldest mental institution in the country, having been known as "New Bedlam" when it was founded some years before the Republic of the United States of America. The card-index system was unbelievably perfect. But young Dr. Braden found John Kingman's card remarkably lacking in the usual data.

"Kingman, John," said the card. *"White, male, 5'8", brown-black*

hair. Note: physical anomaly. Patient has six fingers on each hand, extra digits containing apparently normal bones and being wholly functional. Age . . ." This was blank. "*Race . . .*" This, too, was blank. "*Birthplace . . .*" Considering the other blanks, it was natural for this to be vacant, also. "*Diagnosis: advanced atypical paranoia with pronounced delusions of grandeur apparently unassociated with usual conviction of persecution.*" There was a comment here, too. "*Patient apparently understands English very slightly if at all. Does not speak.*" Then three more spaces. "*Nearest relative . . .*" It was blank. "*Case history . . .*" It was blank. Then, "*Date of admission . . .*" and it was blank.

The card was notably defective, for the index-card of a patient at Meadeville Mental. A patient's age and race could be unknown if he'd simply been picked up in the street somewhere and never adequately identified. In such an event it was reasonable that his nearest relative and birthplace should be unknown, too. But there should have been some sort of case history—at least of the events leading to his committal to the institution. And certainly, positively, absolutely, the date of his admission should be on the card!

Young Dr. Braden was annoyed. This was at the time when the Jantzen euphoric-shock treatment was first introduced, and young Dr. Braden believed in it. It made sense. He was anxious to attempt it at Meadeville—of course on a patient with no other possible hope of improvement. He handed the card to the clerk in the records department and asked for further data on the case.

Two hours later he smoked comfortably on a very foul pipe, stretched out on grassy sward by the Administration Building. There was a beautifully blue sky overhead, and the shadows of the live oaks reached out in an odd long pattern on the lawn. Young Dr. Braden read meditatively in the *American Journal of Psychiatry*. The article was "Reaction of Ten Paranoid Cases to Euphoric Shock." John Kingman sat in regal dignity on the steps nearby. He wore the nondescript garments of an indigent patient—not supplied with clothing by relatives. He gazed into the distance, to all appearances thinking consciously godlike thoughts and being infinitely superior to mere ordinary humans. He was of an indeterminate age which might be forty or might be sixty or might be anywhere in between. His six-fingered hands lay in studied gracefulness in his lap. He deliberately ignored all of mankind and mankind's doings.

Dr. Braden finished the article. He sucked thoughtfully on the burned-out pipe. Without seeming to do so, he regarded John Kingman again. Mental cases have unpredictable reactions, but as with children and wild animals, much can be done if care is taken not to startle them. Presently young Dr. Braden said meditatively:

"John, I think something can be done for you."

The regal figure turned its eyes. They looked at the younger man. They were aloofly amused at the impertinence of a mere human being addressing John Kingman, who was so much greater than a mere human being that he was not even annoyed at human impertinence. Then John Kingman looked away again.

"I imagine," said Braden, as meditatively as before, "that you're pretty bored. I'm going to see if something can't be done about it. In fact—"

Someone came across the grass toward him. It was the clerk of the records department. He looked very unhappy. He had the card Dr. Braden had turned in with a request for more complete information. Braden waited.

"Er . . . doctor," said the clerk miserably, "there's something wrong! Something terribly wrong! About the records, I mean."

The aloofness of John Kingman had multiplied with the coming of a second, low, human being into his ken. He gazed into the distance in divine indifference to such creatures.

"Well?" said Braden.

"There's no record of his admission!" said the clerk. "Every year there's a complete roster of the patients, you know. I thought I'd just glance back, find out what year his name first appeared, and look in the committal papers for that year. But I went back twenty years, and John Kingman is mentioned every year!"

"Look back thirty, then," said Braden.

"I . . . I did!" said the clerk painfully. "He was a patient here thirty years ago!"

"Forty?" asked Braden.

The clerk gulped.

"Dr. Braden," he said desperately, "I even went to the dead files, where records going back to 1850 are kept. And . . . doctor, he was a patient then!"

Braden got up from the grass and brushed himself off automatically.

"Nonsense!" he said. "That's ninety-eight years ago!"

The clerk looked crushed.

"I know, doctor. There's something terribly wrong! I've never had my records questioned before. I've been here twenty years—"

"I'll come with you and look for myself," said Dr. Braden. "Send an attendant to come here and take him back to his ward."

"Y-yes, doctor," said the clerk, gulping again. "At . . . at once."

He went away at a fast pace between a shuffle and a run. Dr. Braden scowled impatiently.

Then he saw John Kingman looking at him again, and John Kingman was amused. Tolerantly, loftily amused. Amused with a patronizing condescension that would have been infuriating to anyone but a physician trained to regard behavior as symptomatic rather than personal.

"It's absurd," grunted Braden, matter-of-factly treating the patient —as a good psychiatrist does—like a perfectly normal human being. "You haven't been here for ninety-eight years!"

One of the six-fingered hands stirred. While John Kingman regarded Braden with infinitely superior scorn, six fingers made a gesture as of writing. Then the hand reached out.

Braden put a pencil in it. The other hand reached. Braden fumbled in his pockets and found a scrap of paper. He offered that.

John Kingman looked aloofly into the far distance, not even glancing at what his hands did. But the fingers sketched swiftly, with practiced ease. It took only seconds. Then, negligently, he reached out and returned pencil and paper to Braden. He returned to his godlike indifference to mere mortals. But there was now the faintest possible smile on his face. It was an expression of contemptuous triumph.

Braden glanced at the sketch. There was design there. There was an unbelievable intricacy of relationship between this curved line and that, and between them and the formalized irregular pattern in the center. It was not the drawing of a lunatic. It was cryptic, but it was utterly rational. There is something essentially childish in the background of most forms of insanity. There was nothing childish about this. And it was obscurely, annoyingly familiar. Braden had seen something like it, somewhere, before. It was not in the line of psychiatry, but in some of the physical sciences diagrams like this were used in explanations.

An attendant came to return John Kingman to his ward. Braden folded the paper and put it in his pocket.

"It's not in my line, John," he told John Kingman. "I'll have a check-up made. I think I'm going to be able to do something for you."

John Kingman suffered himself to be led away. Rather, he grandly preceded the attendant, negligently preventing the man from touching him, as if such a touch would be a sacrilege the man was too ignorant to realize.

Braden went to the record office. With the agitated clerk beside him, he traced John Kingman's name to the earliest of the file of dead records. Handwriting succeeded typewriting as he went back through the years. Paper yellowed. Handwriting grew Spencerian. It approached the copperplate. But, in ink turned brown, in yellowed rag paper in the ruled record-books of the Eastern Pennsylvania Asylum—which was Meadeville Mental in 1850—there were the records of a patient named John Kingman for every year. Twice Braden came upon notes alongside the name. One was in 1880. Some staff doctor—there were no psychiatrists in those days—had written, *"High fever."* There was nothing else. In 1853 a neat memo stood beside the name. *"This man has six functioning fingers on each hand."* The memo had been made ninety-five years before.

Dr. Braden looked at the agitated clerk. The record of John Kingman was patently impossible. The clerk read it as a sign of inefficiency

in his office and possibly on his part. He would be upset and apprehensible until the source of the error had safely been traced to a predecessor.

"Someone," said Braden dryly—but he did not believe it even then—"forgot to make a note of the explanation. An unknown must have been admitted at some time as John Kingman. In time, he died. But somehow the name John Kingman had become a sort of stock name like John Doe, to signify an unidentified patient. Look in the death records for John Kingman. Evidently a John Kingman died, and that same year another unidentified patient was assigned the same name. That's it!"

The clerk almost gasped with relief. He went happily to check. But Braden did not believe it. In 1853 someone had noted that John Kingman had six functioning fingers on each hand. The odds against two patients in one institution having six functioning fingers, even in the same century, would be enormous.

Braden went doggedly to the museum. There the devices used in psychiatric treatments in the days of New Bedlam were preserved, but not displayed. Meadeville Mental had been established in 1776 as New Bedlam. It was the oldest mental institution in the United States, but it was not pleasant to think of the treatmen given to patients—then termed "madmen"—in the early days.

The records remained. Calf-leather bindings. Thin rag paper. Beautifully shaded writing, done with quill pens. Year after year, Dr. Braden searched. He found John Kingman listed in 1820. In 1801. In 1795. In 1785 the name "John Kingman" was absent from the annual list of patients. Braden found the record of his admission in 1786. On the 21st of May, 1786—ten years after New Bedlam was founded, one hundred and sixty-two years before the time of his search—there was a neat entry:

A poore madman admitted this day has been assigned ye name of John Kingman because of his absurdly royal manner and affected dignity. He is five feet eight inches tall, appears to speak no Englishe or any other tongue known to any of the learned men hereabout, and has six fingers on each hand, ye extra fingers being perfectly formed and functioning. Dr. Sanforde observed that hee seems to have a high fever. On his left shoulder, when stripped, there appears a curious design which is not tattooing according to any known fashion. His madness appears to be so strong a conviction of his greatness that he will not condescend to notice others as being so much his inferiors, so that if not committed hee would starve. But on three occasions, when being examined by physicians, he put out his hand imperiously for writing instruments, and drew very intrikit designs which all agree have no significance. He was committed as a madman by a commission consisting of Drs. Sanforde, Smyth, Hale, and Bode.

Young Dr. Braden read the entry

a second time. Then a third. He ran his hands through his hair. When the clerk came back to announce distressedly that not in all the long history of the institution had a patient named John Kingman died, Braden was not surprised.

"Quite right," said Braden to the almost hysterical clerk. "He didn't die. But I want John Kingman taken over to the hospital ward. We're going to look him over. He's been rather neglected. Apparently he's had actual medical attention only once in a hundred and sixty-two years. Get out his committal papers for me, will you? He was admitted here May 21st, 1786.

Then Braden left, leaving behind him a clerk practically prostrated with shock. The clerk wildly suspected that Dr. Braden had gone insane. But when he found the committal papers, he decided hysterically that it was he who would shortly be in one of the wards.

John Kingman manifested amusement when he was taken into the hospital laboratory. For a good ten seconds—Braden watched him narrowly—he glanced from one piece of apparatus to another. It was impossible to doubt that after one glance he understood the function and operation of every appliance in the ultramodern, super-scientifically-equipped laboratory of the hospital ward. But he was amused. In particular, he looked at the big X-ray machine and smiled with such contempt that the X-ray technician bristled.

"No paranoid suspicion," said Braden. "Most paranoid patients suspect that they're going to be tortured or killed when they're brought to a place where there's stuff they don't understand."

John Kingman turned his eyes to Braden. He put out his six-fingered hand and made the motion of writing. Braden handed him a pencil and a memo tablet. Negligently, contemptuously, he sketched. He sketched again. He handed the sketches to Braden and retreated into his enormous amused contempt for humanity.

Braden glanced at the scraps of paper. He jerked his head, and the X-ray technician came to his side.

"This," said Braden dryly, "looks like a diagram of an X-ray tube. Is it?"

The technician blinked.

"He don't use the regular symbols," he objected, "but . . . well . . . yes. That's what he puts for the target and this's for the cathode—Hm-m-m. Yes—" Then he said suddenly: "Say! This's not right."

He studied the diagram. Then he said in abrupt excitement:

"Look! He's put in a field like in a electron microscope! That's an idea! Do that, and you'd get straight-line electron flow and a narrower X-ray beam—"

Braden said:

"I wonder! What's this second sketch? Another type of X ray?"

The X-ray technician studied the second sketch absorbedly. After a time he said dubiously:

"He don't use regular symbols. I don't know. Here's the same

sign for the target and that for the cathode. This looks like something to . . . hm-m-m . . . accelerate the electrons. Like in a Coolidge tube. Only it's—" He scratched his head. "I see what he's trying to put down. If something like this would work, you could work any tube at any voltage you wanted. Yeah! And all the high EMF would be inside the tube. No danger. Hey! You could work this off dry batteries! A doctor could carry a X-ray outfit in his handbag! And he could get million-volt stuff!"

The technician stared in mounting excitement. Presently he said urgently:

"This is crazy! But . . . look, Doc! Let me have this thing to study over! This is great stuff! This is . . . Gosh! Give me a chance to get this made up and try it out! I don't get it all yet, but—"

Braden took back the sketch and put it in his pocket.

"John Kingman," he observed, "has been a patient here for a hundred and sixty-two years. I think we're going to get some more surprises. Let's get at the job on hand!"

John Kingman was definitely amused. He was amenable, now. His air of pitying condescension, as of a god to imbeciles, under other circumstances would have been infuriating. He permitted himself to be X-rayed as one might allow children to use one as a part of their play. He glanced at the thermometer and smiled contemptuously. He permitted his body temperature to be taken from an armpit. The electrocardiograph aroused just such momentary interest as a child's unfamiliar plaything might cause. With an air of mirth he allowed the tattooed design on his shoulder—it was there—to be photographed. Throughout, he showed such condescending contempt as would explain his failure to be annoyed.

But Braden grew pale as the tests went on. John Kingman's body temperature was 105° F. A "high fever" had been observed in 1850—ninety-eight years before—and in 1786—well over a century and a half previously. But he still appeared to be somewhere between forty and sixty years old. John Kingman's pulse rate was one hundred fifty-seven beats per minute, and the electrocardiograph registered an absolutely preposterous pattern which had no meaning until Braden said curtly: "If he had two hearts, it would look like that!"

When the X-ray plates came out of the fixing-bath, he looked at them with the grim air of someone expecting to see the impossible. And the impossible was there. When John Kingman was admitted to New Bedlam, there were no such things as X-rays on earth. It was natural that he had never been X-rayed before. He had two hearts. He had three extra ribs on each side. He had four more vertebrae than a normal human being. There were distinct oddities in his elbow joints. And his cranial capacity appeared to be something like twelve per cent above that of any but exceptional specimens of humanity. His teeth

displayed distinct, consistent deviations from the norm in shape.

He regarded Braden with contemptuous triumph when the tests were over. He did not speak. He drew dignity about himself like a garment. He allowed an attendant to dress him again while he looked into the distance, seemingly thinking godlike thoughts. When his toilet was complete he looked again at Braden—with vast condescension—and his six-fingered hands again made a gesture of writing. Braden grew—if possible—slightly paler as he handed over a pencil and pad.

John Kingman actually deigned to glance, once, at the sheet on which he wrote. When he handed it back to Braden and withdrew into magnificently amused aloofness, there were a dozen or more tiny sketches on the sheet. The first was an exact duplicate of the one he had handed Braden before the Administration Building. Beside it was another which was similar but not alike. The third was a specific variation of the two together. The rest carried on that variation in precise, exact steps until the last pair of sketches divided again into two, of which one—by a perfectly logical extension of the change-pattern—had returned to the original design, while the other was a bewilderingly complex pattern with its formalized central part in two closely-linked sections.

Braden caught his breath. Just as the X-ray man had been puzzled at first by the use of unfamiliar symbols for familiar ideas, so Braden had been puzzled by untraceable familiarity in the first sketch of all. But the last diagram made everything clear. It resembled almost exactly the standard diagrams illustrating fissionable elements as atoms. Once it was granted that John Kingman was no ordinary lunatic, it became clear that here was a diagram of some physical process which began with normal and stable atoms and arrived at an unstable atom—with one of the original atoms returned to its original state. It was, in short, a process of physical catalysis which would produce atomic energy.

Braden raised his eyes to the contemptuous, amused eyes of John Kingman.

"I think you win," he said shakenly. "I still think you're crazy, but maybe we're crazier still."

The commitment papers on John Kingman were a hundred and sixty-two years old. They were yellow and brittle and closely written. John Kingman—said the oddly spelled and sometimes curiously phrased document—was first seen on the morning of April 10, 1786, by a man named Thomas Hawkes, as he drove into Aurora, Pennsylvania, with a load of corn. John Kingman was then clad in very queer garments, not like those of ordinary men. The material looked like silk, save that it seemed also to be metallic. The man Hawkes was astounded, but thought perhaps some strolling player had got drunk and wandered off while wearing his costume for a play or pageant. He obligingly stopped his horse and

allowed the stranger to climb in for a ride to town. The stranger was imperious, and scornfully silent. Hawkes asked who he was, and was contemptuously ignored. He asked —seemingly, all the world was talking of such matters then, at least the world about Aurora, Pennsylvania—if the stranger had seen the giant shooting stars of the night before. The stranger ignored him. Arrived in town, the stranger stood in the street with regal dignity, looking contemptuously at the people. A crowd gathered about him but he seemed to feel too superior to notice it. Presently a grave and elderly man—a Mr. Wycherly—appeared and the stranger fixed him with a gesture. He stooped and wrote strange designs in the dust at his feet. When the unintelligible design was meaningless to Mr. Wycherly, the stranger seemed to fly into a very passion of contempt. He spat at the crowd, and the crowd became unruly and constables took him into custody.

Braden waited patiently until both the Director of Meadeville Mental and the man from Washington had finished reading the yellowed papers. Then Braden explained calmly:

"He's insane, of course. It's paranoia. He is as convinced of his superiority to us as—say—Napoleon or Edison would have been convinced of their superiority if they'd suddenly been dumped down among a tribe of Australian bushmen. As a matter of fact, John Kingman may have just as good reason as they would have had to feel his superiority. But if he were sane he would prove it. He would establish it. Instead, he has withdrawn into a remote contemplation of his own greatness. So he is a paranoiac. One may surmise that he was insane when he first appeared. But he doesn't have a delusion of persecution because on the face of it no such theory is needed to account for his present situation."

The Director said in a tolerantly shocked tone:

"Dr. Braden! You speak as if he were not a human being!"

"He isn't," said Braden. "His body temperature is a hundred and five. Human tissues simply would not survive that temperature. He has extra vertebrae and extra ribs. His joints are not quite like ours. He has two hearts. We were able to check his circulatory system just under the skin with infrared lamps, and it is not like ours. And I submit that he has been a patient in this asylum for one hundred and sixty-two years. If he is human, he is at least remarkable!"

The man from Washington said interestedly:

"Where do you think he comes from, Dr. Braden?"

Braden spread out his hands. He said doggedly:

"I make no guesses. But I sent photostats of the sketches he made to the Bureau of Standards. I said that they were made by a patient and appeared to be diagrams of atomic structure. I asked if they indicated a knowledge of physics. You"—He looked at the man from Washington—"turned up thirty-six

hours later. I deduce that he has such knowledge."

"He has!" said the man from Washington, mildly. "The X-ray sketches were interesting enough, but the others—apparently he has told us how to get controlled atomic energy out of silicon, which is one of earth's commonest elements. Where did he come from, Dr. Braden?"

Braden clamped his jaw.

"You noticed that the commitment papers referred to shooting stars then causing much local comment? I looked up the newspapers for about that date. They reported a large shooting star which was observed to descend to the earth. Then, various credible observers claimed that it shot back up to the sky again. Then, some hours afterward, various large shooting stars crossed the sky from horizon to horizon, without ever falling."

The Director of Meadeville Mental said humorously:

"It's a wonder that New Bedlam —as we were then—was not crowded after such statements!"

The man from Washington did not smile.

"I think," he said meditatively, "that Dr. Braden suggests a spaceship landing to permit John Kingman to get out, and then going away again. And possible pursuit afterward."

The Director laughed appreciatively at the assumed jest.

"If," said the man from Washington, "John Kingman is not human, and if he comes from somewhere where as much was known about atomic energy almost two centuries ago as he has showed us, and, if he were insane there, he might have seized some sort of vehicle and fled in it because of delusions of persecution. Which in a sense, if he were insane, might be justified. He would have been pursued. With pursuers close behind him he might have landed—here."

"But the vehicle!" said the Director, humorously. "Our ancestors would have recorded finding a spaceship or an airplane."

"Suppose," said the man from Washington, "that his pursuers had something like . . . say . . . radar. Even we have that! A cunning lunatic would have sent off his vehicle under automatic control to lead his pursuers as long and merry a chase as possible. Perhaps he sent it to dive into the sun. The rising shooting star and the other cruising shooting stars would be

accounted for. What do you say, Dr. Braden?"

Braden shrugged.

"There is no evidence. Now he is insane. If we were to cure him—"

"Just how," said the man from Washington, "would you cure him? I thought paranoia was practically hopeless."

"Not quite," Braden told him. "They've used shock treatment for dementia praecox and schizophrenia, with good results. Until last year there was nothing of comparable value for paranoia. Then Jantzen suggested euphoric shock. Basically, the idea is to dispel illusions by creating hallucinations."

The Director fidgeted disapprovingly. The man from Washington waited.

"In euphoric shock," said Braden carefully, "the tensions and anxieties of insane patients are relieved by drugs which produce a sensation of euphoria, or well-being. Jantzen combined hallucination-producing drugs with those. The combination seems to place the patient temporarily in a cosmos in which all delusions are satisfied and all tensions relieved. He has a rest from his struggle against reality. Also he has a sort of super-catharsis, in the convincing realization of all his desires. Quite often he comes out of the first euphoric shock temporarily sane. The percentage of final cures is satisfyingly high."

The man from Washington said: "Body chemistry?"

Braden regarded him with new respect. He said:

"I don't know. He's lived on human food for almost two centuries, and in any case it's been proved that the proteins will be identical on all planets under all suns. But I couldn't be sure about it. There might even be allergies. You say his drawings were very important. It might be wisest to find out everything possible from him before even euphoric shock was tried."

"Ah, yes!" said the Director, tolerantly. "If he has waited a hundred and sixty-two years, a few weeks or months will make no difference. And I would like to watch the experiment, but I am about to start on my vacation—"

"Hardly," said the man from Washington.

"I said, I am about to start on my vacation."

"John Kingman," said the man from Washington mildly, "has been trying for a hundred and sixty-two years to tell us how to have controlled atomic energy, and pocket X-ray machines, and God knows what all else. There may be, somewhere about this institution, drawings of antigravity apparatus, really efficient atomic bombs, spaceship drives or weapons which could depopulate the earth. I'm afraid nobody here is going to communicate with the outside world in any way until the place and all its personnel are gone over . . . ah . . . rather carefully."

"This," said the Director indignantly, "is preposterous!"

"Quite so. A thousand years of human advance locked in the skull

of a lunatic. Nearly two hundred years more of progress and development wasted because he was locked up here. But it would be most preposterous of all to let his information loose to the other lunatics who aren't locked up because they're running governments! Sit down!"

The Director sat down. The man from Washington said:

"Now, Dr. Braden—"

John Kingman spent days on end in scornful, triumphant glee. Braden watched him somberly. Meadeville Mental Hospital was an armed camp with sentries everywhere, and especially about the building in which John Kingman gloated. There were hordes of suitably certified scientists and psychiatrists about him, now, and he was filled with blazing satisfaction.

He sat in regal, triumphant aloofness. He was the greatest, the most important, the most consequential figure on this planet. The stupid creatures who inhabited it—they were only superficially like himself—had at last come to perceive his godliness. Now they clustered about him. In their stupid language which it was beneath his dignity to learn, they addressed him. But they did not grovel. Even groveling would not be sufficiently respectful for such inferior beings when addressing John Kingman. He very probably devised in his own mind the exact etiquette these stupid creatures must practice before he would condescend to notice them.

They made elaborate tests. He ignored their actions. They tried with transparent cunning to trick him into further revelations of the powers he held. Once, in malicious amusement, he drew a sketch of a certain reaction which such inferior minds could not possibly understand. They were vastly excited, and he was enormously amused. When they tried that reaction and square miles turned to incandescent vapor, the survivors would realize that they could not trick or force him into giving them the riches of his godlike mind. They must devise the proper etiquette to appease him. They must abjectly and humbly plead with him and placate him and sacrifice to him. They must deny all other gods but John Kingman. They would realize that he was all wisdom, all power, all greatness when the reaction he had sketched destroyed them by millions.

Braden prevented that from happening. When John Kingman gave a sketch of a new atomic reaction in response to an elaborate trick one of the newcomers had devised, Braden protested grimly.

"The patient," he said doggedly, "is a paranoiac. Suspicion and trickiness is inherent in his mental processes. At any moment, to demonstrate his greatness, he may try to produce unholy destruction. You absolutely cannot trust him! Be careful!"

He hammered the fact home, arguing the sheer flat fact that a paranoiac will do absolutely anything to prove his grandeur.

The new reaction was tried with microscopic quantities of material,

and it only destroyed everything within a fifty-yard radius. Which brought the final decision on John Kingman. He was insane. He knew more about one overwhelmingly important subject than all the generations of men. But it was not possible to obtain trustworthy data from him on that subject or any other while he was insane. It was worth while to take the calculated risk of attempting to cure him.

Braden protested again:

"I urged the attempt to cure him," he said firmly, "before I knew he had given the United States several centuries head-start in knowledge of atomic energy. I was thinking of him as a patient. For his own sake, any risk was proper. Since he is not human, I withdraw my urging. I do not know what will happen. Anything could happen."

His refusal held up treatment for a week. Then a Presidential executive order resolved the matter. The attempt was to be made as a calculated risk. Dr. Braden would make the attempt.

He did. He tested John Kingman for tolerance of euphoric drugs. No unfavorable reaction. He tested him for tolerance of drugs producing hallucination. No unfavorable reaction. Then—

He injected into one of John Kingman's veins a certain quantity of the combination of drugs which on human beings was most effective for euphoric shock, and whose separate constituents had been tested on John Kingman and found harmless. It was not a sufficient dose to produce the full required effect. Braden expected to have to make at least one and probably two additional injections before the requisite euphoria was produced. He was taking no single avoidable chance. He administered first a dosage which should have produced no more than a feeling of mild but definite exhilaration.

And John Kingman went into convulsions. Horrible ones.

There is such a thing as allergy and such a thing as synergy, and nobody understands either. Some patients collapse when given aspirin. Some break out in rashes from penicillin. Some drugs, taken alone, have one effect, and taken together quite another and drastic one. A drug producing euphoria was harmless to John Kingman. A drug producing hallucinations was harmless. But—synergy or allergy or whatever—the two taken together were deadly poison.

He was literally unconscious for three weeks, and in continuous convulsion for two days. He was kept alive by artificial nourishment, glucose, nasal feeding—everything. But his coma was extreme. Four separate times he was believed dead.

But after three weeks he opened his eyes vaguely. In another week he was able to talk. From the first, his expression was bewildered. He was no longer proud. He began to learn English. He showed no paranoiac symptoms. He was wholly sane. In fact, his I.Q.—tested later—was ninety, which is well within

the range of normal intelligence. He was not over-bright, but adequate. And he did not remember who he was. He did not remember anything at all about his life before rousing from coma in the Meadeville Mental Hospital. Not anything at all. It was, apparently, either the price or the cause of his recovery.

Braden considered that it was the means. He urged his views on the frustrated scientists who wanted now to try hypnotism and "truth serum" and other devices for picking the lock of John Kingman's brain.

"As a diagnosis," said Braden, moved past the tendency to be technical, "the poor devil smashed up on something we can't even guess at. His normal personality couldn't take it, whatever it was, so he fled into delusions—into insanity. He lived in that retreat over a century and a half, and then we found him out. And we wouldn't let him keep his beautiful delusions that he was great and godlike and all-powerful. We were merciless. We forced ourselves upon him. We questioned him. We tricked him. In the end, we nearly poisoned him! And his delusions couldn't stand up. He couldn't admit that he was wrong, and he couldn't reconcile such experiences with his delusions. There was only one thing he could do—forget the whole thing in the most literal possible manner. What he's done is to go into what they used to call dementia praecox. Actually, it's infantilism. He's fled back to his childhood. That's why his I. Q. is only ninety, instead of the unholy figure it must have been when he was a normal adult of his race. He's mentally a child. He sleeps, right now, in the foetal position. Which is a warning! One more attempt to tamper with his brain, and he'll go into the only place that's left for him—into the absolute blankness that is the mind of the unborn child!"

He presented evidence. The evidence was overwhelming. In the end, reluctantly, John Kingman was left alone.

He gets along all right, though. He works in the records department of Meadeville Mental now, because there his six-fingered hands won't cause remark. He is remarkably accurate and perfectly happy.

But he is carefully watched. The one question he can answer now is —how long he's going to live. A hundred and sixty-two years is only part of his lifetime. But if you didn't know, you'd swear he wasn't more than fifty.

THE END.

THE OBSOLETE WEAPON

BY L. RON HUBBARD

***An obsolete** weapon is, like velocity, time-rate, or any other factor, a purely relative thing. Particularly when some one is careless with a time machine . . .*

Illustrated by Cartier

Rats squeaked, vermin scuttled, drunks stank and the noisome dark oppressed. The American Military Prison in Rome was exceedingly unkind to the senses.

Now that the Tedici had fled northward, American arms sought to integrate a conquest and a people.

In the dankest, foulest cell that G-2 could provide, a brace of allegedly choice criminals kept diffident company.

"Anguis in herba!" howled one from the caldron of his troubled slumber. This, and the other Latin gibberish he had screamed did not soothe his companion who now finally protested.

Danny West was some minutes pulling himself from the muddy maelstrom of his nightmares, but at last he scrubbed his eyes with horny knuckles and blinked nervously at his companion.

"You were dreaming," said his cell mate.

"If that was a dream," said Danny West, "then this cell is Allah's number one Paradise!"

"You're an American, aren't you?" queried his cell mate with polite interest.

"Sure, from Teague County, Texas!"

"Then why the Latin?"

Danny West scuttled backward two feet and watched there, gaping suspiciously.

"What Latin?" he said.

"You just called somebody 'a snake in the grass'."

Danny hedged. "Well he was . . . well . . . er— Forget it!"

"Don't get me wrong," said his cell mate. "You've got me curious, that's all. What are you, an American soldier, doing with a mouth full of Latin?"

"I was associate professor of ancient languages before they snatched me into this cockeyed mess," said Danny West. He was plainly hoping to change the subject. "Lay it to aquavitae."

"Oh, I wouldn't say so. From what I could pick up—"

Danny West looked dangerous.

"Shut up!" he said. "Shut up! Leave me alone!"

There was quiet then, the cell mate having retired offendedly to the farthest corner, where he sat brooding for more than half an hour.

The feeling that he had given offense wore upon Danny. The screaming urge within him to communicate drove him further. At last he crossed the cell and sat down on the blanket alongside his cell mate.

"Have a cigarette," he said by way of apology.

The cell mate took one, looked at it for some time as though doubtful what one must do with such an article. At last he permitted it to be lighted, and drew on it carefully.

"I guess I'd better tell you," said Danny West, the flash boards tearing away from the top of his conversational dam. "I've got to tell somebody! Or I'll begin to think I'm crazy myself."

His cell mate put a lazy guard on his interest. "By all means," he said. "Fire away."

Well—said Danny West—about twenty-four hours ago I was fighting for my life harder than anybody at any training camp ever dreamed of. And the kind of fighting I was doing wasn't included in any training manuals either.

I haven't fought the Germans yet, but when it comes to that, after what I've been through I'll take my chances.

You know how it was yesterday afternoon, just about like it is now, the air hot and thick and a storm coming on. Our outfit had been coming forward for two days without any rest and all yesterday we walked in dust behind tanks for what seemed like fifteen million years.

I was tired. Everybody was tired. But when we got into the city it seemed everybody from the

commanding general down had some lousy fatigue duty for us to do. There wasn't any outfit in the army except Company B of the Nineteenth.

Me, after I put about eighteen billets in shape for other guys to sleep in, I finally got routed out by that stinking captain of ours and told that I had been detailed to re-enforce the local M.P. company. He said there were going to be a lot of riots and that two squads were to go and stand duty for any emergency that came up. We were flying squads.

It had been getting hotter and hotter. Some big clouds slid in over Rome, and finally opened up with enough artillery to end the war.

Our captain marched us down to the Colosseum and then left us standing there in the rain, while he went off to some soft bunk some place.

The sergeant watched him go and the rest of us tried to find a dry spot under the stones. Then the sergeant said: "I got to make a routine patrol," and he disappeared.

Then one of the corporals said: "I got to make a routine patrol, too," and *he* disappeared. And the first thing I know there wasn't anybody left there but me.

Pretty soon this stinking captain of ours came back and in the course of that time I was sound asleep, rain, mud, and all. He gave me a swift kick in the side and says: "On your feet! Attention! What do you mean by sleeping on duty? Where are the others?"

So I says: "They're out making routine patrols, captain."

"I'll routine patrol them," he says and stamps off, probably to find some place a lot drier than it was outside the Colosseum.

I walked up and down for a few minutes but there wasn't anything doing. The population of Rome just wasn't thinking about rioting. It was either kissing the boots of the conquering army, or shacking up, or drowning its sorrows in *vino*.

They had given us riot guns, a couple of bandoleers of ammunition apiece, and three tear gas grenades per man. Then they took away our own weapons, the only ones we knew how to use, as being too heavy for street fighting.

The gun I was carrying must have been made for the Franco-Prussian war. I sat down and looked at it a little while and tried to figure out how the thing worked. I had nothing better to do and you never know in the middle of a war when you're going to need your weapons.

I had to make up my own manual about the thing as I went along but later on I was sure glad that I'd taken the trouble. The old baby was an automatic shotgun weighing about fifteen pounds, with an eight gauge barrel that would have fitted better on a Howitzer. It was full automatic and its ammunition would have broken the springs on a lorry.

I got tired when I was sure the captain wasn't coming back and began to look for a dry hole under

the stones. The lightning kept cracking down like the end of the world. The rain had stopped falling in drops and had joined hands to make close formation. You had to have gills to breathe in that weather.

So I found this hole, and I crawled in. About two seconds later a lightning bolt hit the top of the Colosseum and showered enough mortar down to rebuild a village. That's all I know.

Immediately afterwards I was awakened by the roaring of wild beasts. It was as though a circus tent had caught on fire and the menagerie was fighting its way out. It was a symphony of racket that made the ground shake under me. From the bass roars of the lions to the yelps of the dogs the voice of every animal could be picked out of that din. Cutting through it, weaving circles around it, slicing it up and tramping it down were the trumpetings of at least a hundred wild elephants.

I was lying in straw and the sun was bright through bars. The straw stank, the animals stank, and I was scared. Plainly, somebody had done me dirt.

The walls about me were of wood, except on one side where a grating barred my way. There was no exit that I could find, and my speculations ran the limit from military prison to a new war machine of the Tedici.

It was morning but I had not slept. I was still soaked with the rain which a moment before I knew had been falling.

I didn't really begin to shake though until a hideous crescendo of human screams began to shake the building. There was enough agony in those screams to load a freight train.

My explorations grew swift and I discovered presently that I was not in a cell but in a sort of hallway one end of which was blocked by the iron grate, the other end by a large wooden door. On the other side of the latter I could hear a swelling murmuring sound like a crowd at a football game.

I still had my riot gun, three gas grenades, and, I hoped, my wits. I was about to shoot the lock off the wooden door when a small black dwarf came wriggling up to the iron bars and peered through. He looked, gaped, and quickly ran away.

I yelled for him to come back, and so he did, with a man whose dress had unmistakably not been seen on earth for the last two thousand years.

He was a big man. With one hand he carried a bucket full of live coals and in the other hand he had a long glowing poker. His face was brutal, like a gorilla's.

"Listen fellows," I said, "how about letting me out of here?"

They stared at each other and began a long argument which was punctuated by jabs toward the little man by the big man's hot poker.

For two or three minutes I could make nothing of the conversation until it came to me that they were talking Latin.

I had taught eight straight semesters of Latin at Texas A. and M.,

so it did not take me long to enter into the spirit of the thing.

"Get me out of here," I demanded.

"He's no Christian," said the big man.

"Well, then he's a northman," said the dwarf.

"Northman or no northman he's no gladiator. What are we supposed to do?"

"Get a gladiator and put him in," said the dwarf.

"All right, you run and get Glaucus, and ask him to come here." The big man turned toward me. "Who put you in here?"

"I'm Danny West from Teague County, Texas, and if I don't get out of here pretty quick and report to duty, my captain will make mincemeat out of me. Lemme out of here."

"What kind of a gladiator are you?" he demanded.

"I'm no gladiator, I'm a soldier. And if you don't listen to reason the United States Army is going to be mighty peeved at me."

"You're a gladiator all right, you're just scared. A taste of this iron will cure that. But what are you supposed to fight?"

"Fight? I'm not mad at anybody."

"What d'ya fight? What d'ya fight with? Net and spear? Lions? What?" The big man waved his poker suggestively, and seeing that it had cooled during the argument, thrust it back into the glowing coals.

"I fight Germans," I said.

"Yes, yes, what Roman won't fight barbarians, but I mean in the arena. What d'ya fight in the arena?"

"The . . . the arena—?"

A swelling roar hammered at the wooden door. And a flock of history lit in my lap like a stack of iron plates.

"Well, what d'ya fight?" he persisted.

"Mice," I said. We were getting nowhere.

"What kind of a weapon is that? You can't do anything against lions with a club. No, nor—" he scratched a leprous scalp at the problem.

A small nervous individual, dripping sweat, came streaming up to the bars.

"Who is this? What is this? Oh, I'm ruined. I can never set up a good program unless some fool gums it up. Oh, why was I ever born? What made me ever get into this business? Arrangements . . . arrangements . . . arrangements—One minute it's 'Send the Christians in first.' The next minute it's 'Make it Nubians and lions.' By the guts of Jupiter, I'll retire. That's what I'll do, I'll retire."

"We didn't know he was in here," said the big man. "I left Jocko here."

"Bunglers! Fools! Idiots!" howled the dripping master of ceremonies. "The crowd is getting ugly. That last batch of Christians sat down in the middle of the arena and let the wild dogs run all over them, without lifting a hand. Oh, what poor fodder they send me these days! How can I put on a show—? Take him out of there. Take him out of

there quick. The next act is about to go on. Get Glaucus. Oh, oh, oh, do something! *Do* something!"

But before they could do anything there was a creak, and a groan, and then silence. The big wooden door had slid up and the white sand of the arena blinded me.

Behind me the master of ceremonies groaned piteously:

"It's too late now—it's too late. Throw some lions at him and let's get it over with."

"Get out there you," said the man with the poker, which he used to good effect. I jumped!

"Now see here," I said. But I had jumped so far that I stood outside the door and it dropped with a bang behind me.

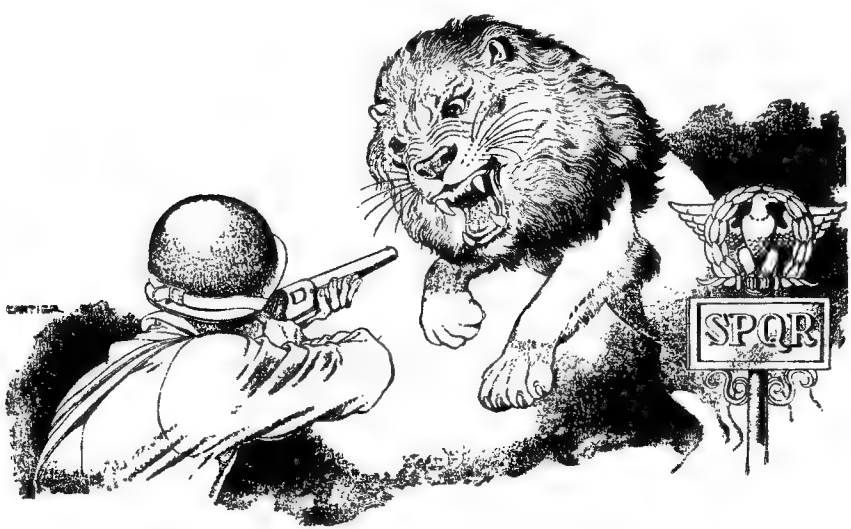
I swear there must have been ten thousand people in the seats around the arena. The sun was beating down and the air was full of dust and yells. Boos and catcalls split through the lower steadier roar of the crowd.

One section was stamping its feet and shouting in time.

"Bring on the Nubians! We want the Nubians! Bring on the Nubians!" I felt a little bit insulted that they would prefer Nubians to me. But they didn't know me after all.

There were pools of blood indifferently spread with white sand all around me. The once white palisades which lifted fourteen feet from the ground to the first boxes were splattered with dried gore. The stench of the place was horrible. Death—rotten meat—and unwashed humanity. I had stage fright.

You couldn't have heard an artillery barrage in the din that rocked the old place. I was trying feebly to collect my wits and find a way out of all this. I had got well into the



realization that something terrible indeed had happened to me when the wooden gates at the far end from me opened—but bounded the biggest lion I ever laid my eyes on this side of the Galveston Zoo.

This lion had something on his mind. His eyes were so red they practically dripped blood. He was so thin that you could see light straight through the middle of him. His tail was ten feet long, or longer, and it was lashing from side to side until you could almost hear it swish. Apparently he was looking for something.

Shortly he found it. Me! I felt like saying, "Now wait a minute fellows, let's sit down right where we are and think this whole thing over. I'm sure we can talk the matter into a reasonable solution."

But the crowd was in a hurry! And the lion was in a hurry! And the riot gun was strapped across my back. I had to do something and do it quick—so I did it!

I dropped on one knee, pried loose the gun, threw a shell under the hammer, and took aim.

Now, shooting lions is not my favorite pastime. I had had a little experience with quail, and one small experience with a deer that got away, but not lions. And the front sight of that gun was weaving around like it was trying to write my obituary.

The lion got within ten feet, crouched down till his belly touched the sand, and then jumped!

There was a blast against my shoulder that knocked me about two feet! When I picked myself up the lion was lying there, all four feet reaching for clouds and clawing.

Though I had been told that hunters were usually pretty proud of their first kill, I never had time to examine this one. They let twelve more lions in through the second door.

The newcomers wasted no time. They saw the dying lion—saw me—and began to whet their appetites at ninety miles an hour. They crossed that arena, the whole twelve of them, like they'd just heard chow call.

I looked to the blunderbuss. They had not even given us instructions as to how to fire the thing, for it was an English gun and they probably didn't know themselves. Like a shotgun it fired paper shells and I was afraid these had swollen in the rain. It fired a mass of pellets something bigger than buckshot and with a very wide spread. Though a few of them would discourage rioters, what did these lions know about the Riot Act?

I watched them sweep down on me. Did you ever see a lion run? Well, mister, they don't run at all, they bound sideways off the ground like rubber balls. A jeep on a Roman road would make a better target.

I put that old museum piece of a shotgun on single and set myself down to knock off the leaders before the main crowd arrived.

Their stink got there before they did. A lion smells like a combination of a slaughter house, a choice

privy, and a dead horse in August. The odor of it, added to my stage fright, was enough to make me lose my boots.

The old gun belted me in the shoulder. The leader plowed sand for fifteen feet. The top of his head was gone! Clean as if he'd patronized an Army barber shop.

The face of the next one just plain disappeared.

The third did five forward somersaults and ended up with his tail pointing at me accusatively. Then came the main herd.

I slipped the gun to full automatic, and let them have it! There were only eleven shells to go but they sure were plenty. There was lion meat stacked around there until it looked as though I had decided to build a castle of the stuff. I remembered how they'd used to feed poor old horses to the lions at the Galveston Zoo. I felt pretty satisfied let me tell you.

I had a breather then. I wiped the smoke out of my eyes and looked around me. I sure thought I'd shown the locals a thing or two. A whiff of the crowd hit me and it stunk almost as bad as the lions. The masses of streamers and faces went up from me on all sides like ranges of mountains. The crowd was quiet and I fully expected them to be something more than curious. However it evidently took a great deal to shake a Roman mob.

I looked at one side where the President of the Games, the Emperor for all I know, and two royal ladies gazed on with indifferent contempt.

They were wearing gold laurel leaves inset with jewels. The box looked like Christmas. On their right sat what I took to be the Vestal Virgins, white-hooded and grim. Most of them, startlingly enough were quite old. Above me out of the quiet drifted the voice of a young buck talking to his girl.

"Like Nero isn't it, to produce magic in the arena. No taste I've always said, no taste whatever. This fellow is simply one of those wizards from Assyria that we've heard about lately. Mass hypnotism you know. There were no lions at all. We merely suppose that they are dead. The thing is really quite simple."

"Gee Marius," said the girl, "you know everything, don't you?"

The one section of the stands which had been chanting before had now recovered from its surprise and began to demand blood. "We want Numidians. We want Numidians. We want Numidians." They chanted, stamping their feet in time.

"Now take earlier this morning," said young Marius, in a bored tone, "those elephants squashing the Christians, now there's what I call a spectacle. And that one elephant that picked up the woman and knocked her head off against the wall. Now that was interesting. But this sort of thing, mere wizardry, chicanery . . ."

The crowd went back to buying nuts and fruit off the vendors. Some other parts of the crowd began to take up the Numidian chant.

I was trying hard to recall how these games were conducted. I finally remembered that after one had killed his meat or his man he was supposed to go before the President's box and ask for the thumbs up or thumbs down sign. So, I began walking toward the President's box.

I was getting my breath back by now for it seemed to me that the worst was over. The crowd was becoming quite impatient with the delay, and as the master of ceremonies had said, was obviously in an ugly mood. Boos, hisses, catcalls, and an occasional hunk of rotten fruit began to descend into the arena.

"We want action," bawled a tubby man above the palisades. "We came here to see a spectacle. We want action. We want blood!"

Others in the crowd began to take up his chant. Soon the ground under my feet was shivering with it. I never did get close to the President's box. For, about halfway en route the tone of the crowd changed so quickly and to such a pitch of enthusiasm that I knew I was in for more.

The master of ceremonies was evidently on his toes. I turned around quickly. A gate was opening and two net-and-trident men sped out into the arena, holding up their weapons for acclaim. They were evidently quite popular for they were greeted with cheering.

They wasted little time for a fast victory was what was wanted. They closed in. One circled wide until he had gained a distance on my left. The other held his ground on my right. Then they rushed me!

I didn't like to do what I did. But I dropped to one knee and leveled on the first one.

BOWIE!

He flew apart in mid-rush.

I swiveled around and found the other one within ten feet of me. Startled by the fate of his friend he drew and then pitched his trident at me. Its middle prong hit my helmet with a clang, and the weapon went zooming off in a new direction.

He spread and cast the net before I could catch him in my sights. The thing settled over me like a thousand spider webs.

He rushed to retrieve his trident and had picked it up when—

BOWIE!

He went to join his companion on the banks of the Styx.

"Boo," yelled the crowd. "Boo, magic, fake!"

Nevertheless I approached the President's box again. I stood beneath it. If this was Nero, then I had not looked to find the handsome young fellow that he was. A dissolute mouth was all that marred his face. I took the woman on his right to be his mother and sweetheart, Agrippina.

"Boo! Fake!" screamed the crowd.

Nero looked over the edge of his box at me. Ceremoniously he raised his right hand. And then with a savage gesture struck his thumb down.

This appeared very silly to me since there was no other combatant

in the arena, and I certainly was not flat on my back awaiting a coup.

The crowd echoed the sentiment and the master of ceremonies must have been looking for within the space of a minute three doors opened and at least seventy-five Numidians dashed with a war cry into the arena.

Each one of them looked about fifteen feet tall, shiny black, wearing ostrich plumes and carrying assagais. They danced, and bounded, and waved their weapons and leather shields. They drew up into a formation approaching a phalanx and after pausing long enough to be acclaimed started for me.

I turned sideways and yelled at Nero: "Hey you, this isn't fair!" Nero grinned ghoulishly at me. I turned back and looked at the Numidians.

I was scared. My blood clogged my veins. Maybe it was the war cry, maybe it was the shiny black bodies, maybe it was the savage teeth. But the one place where I wanted to be at that minute was back in Teague County, Texas, eating some of my mother's corn bread.

I had reloaded the riot gun in front of the President's box but I knew better than to try to spray that mob.

Something was banging against my hip. I recalled the tear gas grenades. I unhooked one and pulled its pin. I counted to three and chucked it. It burst immediately before the phalanx and sprayed dots of white smoke in all directions. The Numidians vanished in a cloud of it.

All of a sudden I felt like laughing. Maybe it was hysteria, but those black boys had looked so gay and so brave dancing in that the contrast was very funny. They came out of that cloud in the formation of scattered rabbits. They were doubling up, and wailing, and clawing at their eyes. They were calling out the names of their various gods and rolling on the ground.

Their shields and spears were thrown in all directions. However, the crowd was not amused.

"Boo!" "Fake!" they jeered.

But the Numidians didn't jeer. They went over to the edge and found places to sit down, or they bumped into each other, or they tried to climb up the palisades. It came to me that they were more scared than hurt.

"Charge me, will you?" I yelled at 'em. Then I went out to pick me up a cluster of ostrich plumes, hoping that this act would mollify the crowd.

During this operation it seemed to me suddenly that I was acting very foolishly. Here I had all the weapons that they didn't have, obsolete as I considered them, and all I needed to do was to blast the lock on one of those doors and walk out of the place.

There was little enjoyment in the arena for me. Sooner or later somebody was going to get hurt.

I threw down the ostrich plumes and rushed toward one of the doors.

But there the Roman guards threw the dice for me and got "crap."

That door came open with a bang! And there I was looking down the trunk of the biggest Indian elephant that was ever born. If P. T. Barnum had seen that elephant, he would have gone crazy and billed him all over the world. That elephant was so huge he could have used the Empire State Building for a toothpick. What made him look all the more horrible, they had thrust burning sticks and barbs under his skin until he looked like a porcupine.

Somebody—probably my old friend—was jabbing him with a red hot poker from behind. And the elephant came out of there!

He saw me!

He was delighted!

He reared up until there was an eclipse of the sun. He aimed two feet twice as big as kettledrums right at my head.

His tusks gleamed. His teeth gleamed. His eyes gleamed. And froth sprayed out of his mouth like a flame-thrower.

Hurrahs and hurrays bounded around that arena from a delighted crowd.

I had brought up so short at the sight of this world-ender that I sat down, directly under him. The butt of the riot gun hit alongside of me. My finger threw it on full automatic and I let him have the entire chamber as fast as I could shoot.

Pieces of elephant meat flew all over the area, the palisades, and me. When he hit earth again his trunk slammed me sideways about thirty feet. I picked myself up. But there was no more fight left in that elephant.

These people were getting too rough to suit my fancy and once more I started to get out of there. A scream of surprise and delight from the crowd made me turn again.

A second elephant twice as big as the first one had been let out of the arena! He was bearing down on me like a combination of the Graf Zeppelin and a General Sherman tank. My error was that I was the only one in motion in that arena. He ran over about five Numidians getting to me.

The Society for the Prevention of Cruelty to Animals will probably never hear about this but my riot gun was empty. There was nothing else I could do.

I unhooked a second gas grenade from my belt and pulled the pin. When he was within thirty feet of me I heaved it into his open mouth.

BOWIE!

That elephant's head like to have torn off. He couldn't stop because he was going too fast. His front legs folded up and his hind end came on over them. I jumped sideways just in time to miss him. He did two complete somersaults and wound up with a crash against the boards right underneath Nero's box.

I was surprised, to say the least. I hadn't expected a tear gas bomb to kill him. But from the look of the way he was heaving and shuddering that elephant was halfway to his happy hunting ground already.

The little torches jammed into his

side began to flicker out. The smoke from them drifted around him like a shroud.

The Numidians had drawn off to the farthest point of the arena. The crowd now took to jeering at them. Two of them advanced as though to prove their metal. The riot gun took care of that.

"Let me out of here," I yelled at Nero. "I'm Danny West of Teague County, Texas. And you'd better be careful next time where you get your gladiators. Let me out of here!"

But Nero Germanicus and his party were not thinking about gladiators. The tear gas had fumed out through the twitching trunk of the elephant. It had wheezed from his scalded lungs to work its way upward and drift into the President's box. His mother and the ladies of the court had scrambled awkwardly backwards to the walkway above. Nero now stood crying the first and last tears of his merciless life.

I glanced around the arena. The crowd was plainly scared. And that, my friend, is an accomplishment, for the impressing of a Roman crowd was a thing for which men sold their lives. It began to come over me what I had done.

I looked around me. That arena looked like a dance hall after The Longshoreman's Ball. Dead lions and elephants were stacked up like the Chicago stock yards. Numidians, dead, wounded or terrified were black or red spots on the white sand. Above them the crowd was beginning to surge away from the palisades.

I could see young Marius and his girl. From the expression on his face he had ceased to be convinced of the authenticity of necromancy.

I swelled out my chest and strutted a little bit. Such was my confidence that I missed a second vital fact—when a Roman crowd gets scared it kills.

And when a Caesar is offended—

Up until this time I had not paid particular attention to the glittering helmets and shining spears of the household troops which surrounded the box of Nero Germanicus Caesar. They were fine big Germans. And though they might have been the ancestors of the Tedici we were supposed to fight in Italy they were very far from bones. Six feet six, most of them, picked for their size and courage. They served Caesar with a fanataeism born of the fact that without Caesar alive they themselves were dead before the Roman mob. So little was Nero Germanicus loved at this time that he was accustomed to placing large troops about the city.

So it happened on this luckless day that the Tenth Legion with all its panoply and fine training from across the Rhine was home and at hand.

I saw the courier go and though I didn't know his message I decided not to stay. The stiffening legs of the elephant and his massive body made a sort of a ladder up to the box. Of this I took advantage.

I know more about mounting horses than elephants but this one

was bottom side up. I scrambled to his belly and then up his leg to grab at the top of the palisade. I was very engrossed in my effort since my equipment was not light and I was carrying that riot gun handy, reloaded. It was only a cheer from the crowd which made me look up.

I was staring at the points of twenty leveled spears, backed by the blond beards of the household guard.

Behind them and above them Caesar was smiling. It was his trick. I heaved myself down off that leg and under the protection of the elephant while all twenty of those spears bit meat close behind me. But it was elephant meat, not Texan.

I stuck my head up again through the small forest and I leveled the riot gun. Three of the bodyguard had already begun to come down the elephant's leg. They came down all right.

BOWIE! BOWIE! BOWIE!

Tedici! Well, I'd come to Italy to fight Germans but I didn't know that I would find them in the accoutrements of Roman Legionnaires. The riot gun let out a long roar. And the palisade above me was cleared! I reloaded and again stormed the ramparts.

I don't know where they came from but they sure came in a hurry. Plumes, spears, and helmets jammed the runway which led outward from the President's box. The Tenth Legion was on its way.

The Roman mob was cheering itself into laryngitis. All of a sudden I got mad.

They'd come to see blood. Well, they were going to get blood. That riot gun blew down the first ranks of the Tenth Legion like a lawnmower. Their armor corselets might as well have been made of papier-mâché. The Numidians had been whipped up till now but they knew that they would die anyway unless they did something. So I received a rear attack.

Other companies of the Tenth Legion were flooding down into the arena from the boxes on either side of the President's box. It was getting hot. I realized that it was certainly no place for Danny West.

I pulled the pin on the last tear gas bomb and pitched it up into the runway behind the President's box where it jetted white.

I dodged about twenty spears and got up on the elephant again. From there I gave 'em a full burst

from the riot gun. I reached the palisade and climbed over into the chair that Nero had so recently occupied.

If the simple act of grabbing a throne would have made me Caesar, then I was Caesar. But I was sure sorry for it. You've seen it rain in a hurricane down in Galveston? Well, those big long slanting drops weren't anything compared to the number of javelins that were in the air around me then.

One clanged off my helmet and almost knocked me silly. Some archer got to work and began to stud the woodwork with arrows. Ahead of me I could see the open runway, cleared now.

I shut my eyes to dash through the tear gas. Then came the main bulk of the Tenth Legion. They blocked that exit like pickets make a fence. I backed up. I turned to see that the crowd itself with cushions and baskets for weapons had begun to back up the remaining Legionnaires, household troops, and Numidians. All it required now was a pack of wild dogs and another flock of lions to make this a real Roman holiday.

I let the riot gun go back into that press and then grabbed for the bandoleer to reload. There was just one chamberful left. People were behind me and above me, Legionnaires were in front of me and in short it was no place for a self-respecting Texan boy to be found.

Right about then I figured I was just so much lion meat. But I started up the ramp intending to find another way out. Then the impossible happened.

I fell flat on my face, slipping in the blood which spattered the runway. And before I could regain my feet a bolt of lightning hit the Colosseum.

It missed Nero who had probably fled to the Palatine Hill by then. But it sure made hash out of the rest of the crowd.

I hid my face in my arms but it didn't come near me. It was a funny kind of lightning. It rolled around the arena in big yellow flashes. The whole crowd either dived under seats or died where they stood.

The Tenth Legion, versed in all the lore of ancient superstition, saw that lightning and left their spears behind them.

I scrambled to my feet but I got up a split second too soon. There was somebody above me. And he was yelling. I couldn't make out anything in the roar of that arena. This guy came over the side of the runway and lit beside me. But Danny West wasn't waiting to be detained.

I let him have a clip alongside of the neck and grabbed at his hands which I figured held a knife. Something came away and then I fell. About ten million volts of lightning went around the place once again.

That's all I know until I woke up being kicked in the side. It was raining. It was morning. It was Rome. And from the empty sardine can alongside of me I knew that the army of occupation was at hand.

"Get out of that, you deserter!" said this stinking captain of ours.

I looked up and I swear I could almost have kissed the guy, as much as I hated him.

"Where have you been?" he demanded. "What have you been doing? What do you mean by dishonoring me and disgracing your company?" And then without waiting for me to answer any of these questions he launched into a tirade that would have done credit to a West Pointer.

He told me that I was guilty, as near as I could gather, of at least twenty-nine of the first thirty articles of war. Not the least of which was pusillanimous conduct in the face of the enemy.

It seems there had been a riot the night before and I hadn't been there. Though I tried to convince that stinking captain that I had been in a riot that made *his* look mighty pale there wasn't any talking past that high grade flow of official redundancy.

He had two M.P.s onto me like setter pups after a quail. He took the riot gun away from me and booted me all the way down to the military prison. So here I am and all I got to show for it is this here fountain pen I took out of that bird's hand just before the lights went out.

He held up a small gray object to his cell mate and relapsed, looking glum.

His cell mate looked at him pensively.

"Well?" demanded Danny West pugnaciously, "Go ahead and call me a liar."

His cell mate's eyes shifted from Danny's face to the souvenir he held in his hand. He regarded it critically.

"And where did you keep it?" he said.

Danny West gestured at his boot: "In here. Those M.P.s would take your gold teeth off of you."

The cell mate seemed a bit nervous.

"Let me see it."

"O.K., but you've got to hand it right back."

Danny West extended it to him nearly dropping it. His cell mate turned white and grabbed it just before it touched pavement. Caressingly he looked it over, wrapped it in his handkerchief and thrust it in his pocket. He stood up.

"See here," protested Danny West, "where are you going with that?"

"It happens, regrettably, that it belongs to me," said the cell mate.

"You? Now look here, I took that off a guy—" A dawning expression came over Danny West. He jumped to his feet and pointed. "Then you—"

"Yes," said the cell mate bowing slightly.

"But how—?"

His cell mate deepened the bow and took from his pocket a small metal card not much bigger than a dog tag but made of some glittering substance of which Danny West had no acquaintance. The Texan read it with growing awe.

"We didn't intend to land here,"

said the cell mate, "but we were caught without water and unfortunately the navigator and the captain chose the middle of the Italian desert in which to find it. We have not been much acquainted with these things for some time so you will excuse our ignorance.

"I used a certain device of ours to go back to a period when water had been there. But unfortunately I got somewhat scrambled in my dates. Your little show in the arena which, by the way, I wouldn't have missed for worlds, sidetracked me farther into this place."

He was moving toward the door as though his mere gesture would open it.

"But here," he said turning towards me, "I won't be too hard on you. I'm sure if you tell the captain that your part in the riots was well played, proving it by your empty bandoleers, he will be very happy to let you off—particularly since you can make him a present of one of the jewels in these."

Saying which, he drew out of his knapsack the gold laurel leaves which had been worn by Nero Germanicus and his consorts. He handed them to Danny West. And even in the prison gloom the round-cut gems gleamed. The gold was so soft you could bend it with a finger.

"You won them fairly," said the cell mate. "Anybody but Nero would have considered the show quite good enough without turning loose the Tenth Legion on you."

Danny West was agape. "But look here, how—?"

"It's simply that I got to Rome when I should have gone to Italy," said his cell mate. "Now, if you'll give me my identification."

Danny West read it again. The rest of his life those words would be engraved upon his memory.

MORTAN, DAGGER B. 116335
MECHANIC 1st. CLASS
ROCKET TURBINES
INTER-SYSTEM SPACE-WAYS
INOCULATED 10-JULY-2595
BLOOD TYPE 0

Danny West gave it up, numb with awe. His cell mate was applying a small gadget to the lock which dripped in large globules of iron upon the pavement.

"But wait a minute," said Danny West, "that lightning— That must have been—"

"Yes," said his cell mate, "this little gadget which you so carelessly supposed to be a fountain pen was the author of that. It's not very much. The pile cell in it is almost worn out. It's a sort of obsolete weapon you see."

His cell mate walked through the swinging door and then seemingly through the solid rock wall.

A long time after he had gone Danny West stood, arms hanging limply, still holding the laurel leaves. His mouth was forming the parting words.

"An Obsolete weapon!"

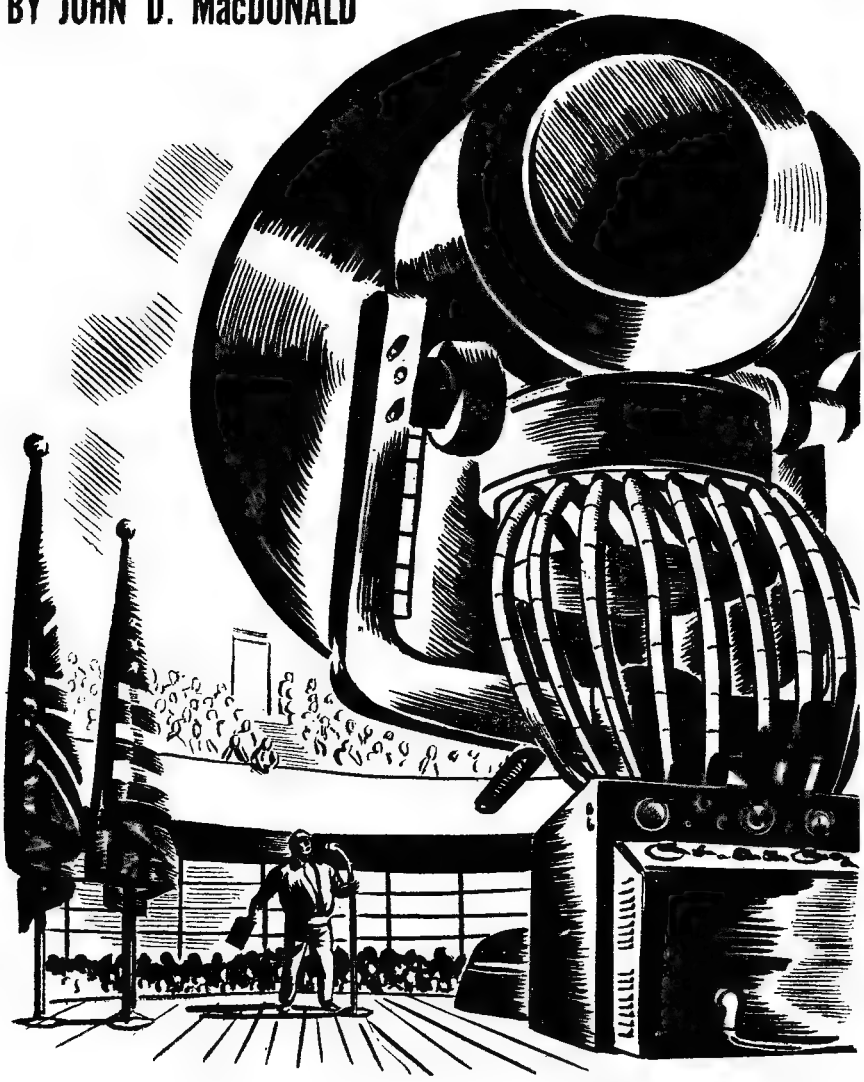
THE END.

THE MECHANICAL ANSWER

***A suggestion** on the problem of a true thinking—not simply calculating—machine. And a suggestion, too, that not even the ultimate thinking machine can answer the most fundamental of human questions!*

Illustrated by Timmins

BY JOHN D. MacDONALD



Jane Kayden, the traces of dried tears on her pretty face, said, in a hopeless tone for the hundredth time, "But why does it have to be you, Joe?"

Joseph Kayden, Director of Automatic 81, paced back and forth through the room of their apartment that they called the Main Lounge. After they were married, when permission was given for Jane to live on the premises at Automatic 81, she had designed the apartment. Automatic 81 was in the Mesilla Valley, eighteen miles from Albuquerque.

The two opposite walls of the Main Lounge were of clear glass. One wall looked out across the valley. The other looked out across the vast production floor of Automatic 81, where the humming machine tools fabricated the portable tele sets. Automatic 81 was a nearly average government facility, with all unloading and sorting of incoming raw materials, all intraplant transportation of semifabricated and completed parts, all assembly and all inspection, all packing and labeling accomplished by the prehensile steel fingers of automatic equipment. Joe Kayden, lean and moody, was the director and only employee.

On the end wall was the warning panel. With any breakdown, a buzzer and flashing lights indicated the department and the specific piece of equipment. That portion of operations dependent on the breakdown stopped automatically until the production break was repaired. Kayden was responsible for the complete operation and maintenance. Each month his production quota figures were radioed from Washington and he adjusted his production to fit the quota.

He stopped by her chair and looked down at her, his bleak look softening. "Honey, I can't say no. The government spent eight years and a lot of money filling my thick head with electronics, quantum mechanics and what all. I'm their boy and when they say jump, Joe jumps."

"I know all that, Joe. I know that you can't quit. But why do they have to pick you? They've got what they call their high-level people, the theorists and all. People all wound up in the philosophy of mathematics. You're one of the workers. Why does it have to be you?"

He held his hands out in a helpless gesture. "I don't know. But I can make a guess. They've been appropriated two hundred million a year for the past four years on the project and they aren't getting anywhere. So I guess that some congressman has told them to bring in one of the practical boys from the Department of Civilian Production. They picked me."

"Out of over two hundred men they picked you? Why, Joe? Why?"

"Because I've never missed a quota. Because I've cut the warning board down to less lights than any other outfit. Because I rigged up a new standby system and because I shifted more maintenance over to automatic equipment than anybody else. They just stuck the two hundred and something cards in

the sorter and sorted for the guy with the most practical imagination and the best ratio of accomplishment. My card dropped out. So they called me up and said, 'Come on down here to Poughkeepsie, Joseph, and take over the Thinking Machine.' "

Out of the midst of her distress, she looked at him proudly and said, "You have done a good job, Joe."

He kicked a small stool closer to her chair, sat on it and took her hand. "Here is the big trouble, Jane. They don't know it and I don't think you do either. But by myself I couldn't have done these things. You're the guy who has . . . what do they say? . . . given me pause to think. You don't know a thing about production or about electronics, honey, but you've got a terrific quotient of horse sense. You've made me see things about this place I'd never have seen by myself. The board is small now because you did so much griping about how much of my time answering the board took. Remember all the times you've started a sentence with, 'Why don't you—?' "

"Yes, but—"

"You've brought the simple outlook of a child to this problem and all I've ever done is take your direct ideas and put them into shape. They don't want me, they want us."

She brightened visibly. "Then why can't—"

"No. They won't do it. They've surrounded the whole project with a batch of phony secrecy. Back in the days when it was called a Project to Develop a Selective Mechanical, Numerical, Semantic and Psychic Integrator and Calculator, we could have both gone on the job. But then, after the press got hold of it and labeled it the Thinking Machine and stated that in the field of warfare it would give better, quicker answers than any General Staff, the War Department made it Top Secret and that's the way it stands. For you it would be no soap."

The quick tears came again. "Joe, I'll be so lonesome!"

"So will I," he said quietly.

"And I'll be afraid, Joe, darling. Remember when you met Toby Wanderer in El Paso? Remember what he said?"

Kayden nodded. He remembered. Toby had just been fired from the Thinking Machine Project. Not fired, really, but retired with a pension for life. Poor Toby. Toby had got a bit tight and talked more than he should have. He talked about the tremendous strain of the Project, of the strange mental breakdown of the men who worked on it. Something about a machine to duplicate the processes of the human mind. When Toby had cracked the first time, they had given him shock treaments and put him back to work. Finally the interval between the necessary shock treatments grew too small and Toby was given his pension. Toby had cursed the Project with cold fury and said that it was impossible—that the most they'd ever accomplish was a machine which could duplicate the mental processes of a four-year-old child, emotionally unstable, with a limited I.Q. for its years.

Unfortunately Joseph Kayden had told Jane the entire story, never believing for a moment that he would be selected to join the Project, that political expediency would result in his being placed in charge. It was obvious to him that his appointment had been made out of desperation.

"Will you be able to write me?" Jane asked.

"Probably. With censorship. And out of the goodness of their heart they give me two days chaperoned leave every two months."

It was time to leave. The shuttle aircraft was due. Joe packed moodily while Jane wept some more. The shuttle would bring the new man for Automatic 81. He'd live outside until Jane could find a place to move their possessions to.

At last he was packed and they stood, his arms tight around her, her fair hair brushing his cheek. He whispered, "I'll probably make a blob of it, honey, and they'll boot me out quickly. To keep yourself busy, why don't you brush up on your neurology and psychiatry?"

When he kissed her, her lips tasted of salt. His last look at her was from fifteen hundred feet. She was a forlorn figure, standing out on the patio, waving listlessly.

He was a pale man, almost luminous in his pallor, and he announced himself as Roger Wald, Kayden's Executive Assistant. Wald flapped his pale hands and Kayden thought that he looked as though his face was of moonstone dust, held together with luminous putty.

"How long have you been on the job here, Wald?"

"Oh, over two years. I've been the assistant to some very great men and—"

Kayden grinned. "Yeah. And now you're the assistant to a guy with grease under his fingernails. Buck up, Roger. I brush my teeth and everything."

Wald flapped his gray hands some more. "Oh, I didn't mean to imply that—"

"Skip it, Roger. You just keep telling me the score and we'll get along fine. Is this my room?" Wald had led him into a small plaster cubicle containing one single bed, a chair, a bureau and a glass ash tray.

"Yes, it is. I admit it's a bit bleak, Mr. Kayden—"

"Call me Joe, please."

"Yes sir. The room is bleak. They all are. Dr. Mundreath who was in charge three years ago felt that there should be no distractions, you know."

"No, I don't know. Let me check this. I'm in charge?"

"Oh, yes sir."

"Then your first job, Roger, is to get me a suite of rooms. I want luxury on a Sybarite scale. I want rooms with music, tele sets, wine lists and everything but beautiful hostesses. Got it?"

"Yes, sir."

"Now show me the production setup, the labs and all."

The Project was housed in a series of long, one-story buildings surrounded by a high electrified wall. Interception rocket stations

were set up in profusion in the surrounding countryside, the scanners revolving perpetually.

One building housed the best approach to a Thinking Machine that had been devised. The guard let them through the door and Kayden stopped dead. The main room was five hundred feet long and about eighty feet wide. All along the walls stood independent units of the machine. Each unit was plastered with switchboard panels, plug sockets and lamp indicators. Between the interstices of the panels showed an array of electronic tubes, circuit elements, relays.

Kayden looked at a small vehicle rolling smoothly across the floor. A uniformed girl sat in it and guided it. He recognized it as a massive variation of a master programming unit. The girl wheeled it up to one of the independent units against the wall, consulted a chart and plugged in the programming unit. The indicator lamps glowed and the girl took the tape that was ejected from the wall unit. She glanced at it, unplugged and wheeled away toward a far part of the room. He could see at least a dozen other master programming units.

"What are they after?" he asked Wald.

"Test problem. With each improvement in the basic equipment, we run the same test problems through."

"What's the problem they're working on now?"

Roger Wald beckoned to one of the girls on the vehicles. She stopped beside them, smiled prettily.

"Mr. Kayden, Miss Finch. Miss Finch, what is the test problem?"

"Chemical exchange separation method, Mr. Wald."

The girl drove away on the silent wheels. Wald said: "We just feed the machine all the factors of a problem—i.e., to devise a simple way of preparing carbon-13 compounds. We know the answer, of course. Other test questions concern other fields—rules of harmonics, heat radiation and so forth."

They walked into the room and, as Kayden looked more closely at the independent units, he began to see the point of approach to the problem. He said, "Give me a short statement of the reasons for failure."

Roger Wald bit his lip. "My training . . . I'd better get Dr. Zander for you. He's in charge of testing and analysis of results. We'll go to his office."

Zander was a man constructed of overlapping pink spheres. His face was covered with a constant dew of perspiration. He had the build, the complexion and the blue eyes to go with what should have been an amiable disposition. But his small mouth was an upside down U of sourness, his eyes were smothered bits of blue glass and his voice was a nasal whine. He looked at Kayden with what could have been contempt. Kayden sat and Wald stood on the opposite side of Zander's paper-littered desk.

"So! You're the new director," Zander said.

"Right. Glad to know you, Dr.

Zander. I've heard about you. Suppose you give me a brief on the present difficulties."

"You want it in layman's language?"

Kayden smiled with his lips alone. "I think I can struggle through the big words with you, Doc."

Zander frowned and put his fat fingertips together, stared at Kayden through the puffy arch. "History first. By 1953 the Electronic Mechanical and Numerical Integrator and Calculator was carried to a point of development where it could solve any problem given to it in the mathematical field, provided the automatic sequencing was fed to it on a paper tape or punch cards. Iconoscopes were set up to act as accumulators to expand the memory factor, and calculations were put on the binary obviating the use of digits two through nine.

"With the first appropriation to develop a Thinking Machine, as it is called by the layman, our problem was to switch from mathematics to semantics. In other words, instead of absolute figures, we had to change over to the fuzzy values of words and phrases. Instead of asking for the cube root to ten thousand places of minus two, we had to ask it what happens when a cat is shot through the head and have it answer that the cat dies. As simple as that.

"To make the changeover, we had to select a language for it. We selected English and took out all variations which add little or nothing to connotation. We gave each sound a numerical value, and combined the numerical values into words. Then, into the expanded memory factor, we fed thousands of truisms. Naturally, with number-sound valuation, each truism became a formula . . . an equation. Assume that we had fed into the memory factor the phrase, 'Roses are red'. The machine tucks it away as a numerical formula. Then we ask the machine, 'What color are roses?' It translates the question into an open-ended formula, digs into the memory chamber and says back to us, 'Roses are red.'

"Now we can ask a question based on any truism or proven statement that we have fed the machine, and we get the answer. We get it either written or spoken, though I personally consider the vocal attachments to be more toys than anything practical. The voice makes an impression on distinguished visitors, particularly when we permit the visitor to ask his own question. It is embarrassing when the question concerns a statement not previously fed to the memory factor. One congressman asked when his mother would die. The machine gave him a detailed definition of the word mother and a physiological explanation of the meaning of death—what happens when death occurs.

"The next step was to teach the machine basic differentiations. We selected a quality—such as calorie content. Then we stored in the memory factor a complete list of caloric ratings of food. Now, if you ask it the calorie rating of a given food, it will answer, or if you ask it which of two foods has the highest rating, it will select the

proper answer. We have fed the machine eighty thousand differentiation lists covering eighty thousand different methods of grading myriad items.

"In addition," he continued, "we have read to it philosophical concepts, records of phenomena, all types of data and information. At the present time we have a superabundance of response. Should you feed it just one word, such as 'steel' or 'indigestion' the machine will give you several volumes of data."

Kayden nodded. "All you've done, in other words, is build yourself an automatic library."

Zander's eyes widened and narrowed quickly. "You are perceptive, Mr. Kayden. In effect, that is what we have. As yet we have no indication of the least creative impulse in the equipment, or how to initiate it. We have had hopes. At one time, in answering an astronomy question the machine faltered and then wrote, 'The moon is ardium.' We were excited and we speculated about new elements, until we discovered that it was merely a partial short in the wiring that had escaped the specialized equipment we have built for the sole purpose of diagnostics and repair."

"And what is the current program?"

"We are feeding the machine more data each day. Each day we expand the memory factor. Our present theory is that eventually, under the pure mass of data given it, the machine itself will break down. Psychoneurosis on a mechanical plane if you will. The place and manner of the breakdown may in itself stimulate us to provide it with some form of intellectual selectivity." He smiled woodenly. "We would all be very happy if the last words of the machine were, 'The hell with it!'"

"But you keep giving it these problems."

"Quite right. The problems are our control. So long as the machine merely repeats back to man what man has fed into it, it will be a failure. So far, that is all that it does. The problems are our continual check to see if by any chance the machine has struck on any creative method."

"If the creative method isn't built into it, how do you expect it to acquire it?"

Zander's smile was broader. "That, my young friend, was the problem which stopped your predecessor. And now it is your problem. If you want to come with me, I'll show you the mechanics of the machine."

Kayden rubbed his forehead with the back of his hand. "No thanks. I'll look at the woods from a distance and climb the individual trees later. I want some time to think about it."

Zander stood up, smirked. "What are your orders, sir?"

Joseph Kayden looked at him in irritation. "Follow existing orders until they're countermanded."

Zander sighed, smiled in a superior fashion and picking up some papers from his desk began to work.

Outside Roger Wald said, "He

. . . he's a bit peculiar, Mr. . . . I mean . . . Joe."

"O. K. I'm going to wander around. You get me fixed up with something to live in besides that shoebox with running water." Wald hurried off.

Kayden wandered around. He talked to watchmen, electricians, lab assistants, cooks, janitors. At six he was back in his room with his mind full of figures. Nearly nine hundred people lived and worked within the Project Area. Since its inception, the Project had used up over nine hundred millions. There was little chance of a complete cancellation of the Project, as no politician would be willing to take the chance of saying to the people that all that had gone before was a dead loss.

He sat on his bed and stared out the window at the low, pale buildings. Someone had told him that he had an office, but he was too discouraged to even find it. Probably a secretary or two went with the office. "What are your orders, Mr. Kayden? What are you going to do next, Mr. Kayden?"

Roger Wald came at six, eager and breathless. "Your place is ready, Mr. Kayden. I ordered a complete pre-fab, entirely equipped. The crew has offloaded it at the north end of the area." Wald had one of the little cars used within the Project area waiting and he helped Joseph Kayden with his luggage.

The pre-fab was small, but luxurious. Kayden felt better as soon as he walked in. He said, "All I need now is Jane."

"Jane?" Wald asked politely.

"My wife."

"Oh, of course. Too bad she isn't permitted."

"I'd like to take a run down to New York and get stinking," Kayden said wistfully.

Wald flapped his pale hands. "That isn't allowed either."

Wald had dinner brought to the pre-fab and they ate together. After dinner he sat in front of the synthetic fire, after shooing Wald away, and began smoking jittery cigarettes.

"Jail," he muttered. "Prison! What am I accused of, judge? Joe Kayden, head of the Automatic Mechanical Library of Nonessential Information. I'd like to kick Zander's fat head. What do they expect me to do? Hide inside the machine and give the right answers?"

He walked nervously back and forth through the rooms, kicking petulantly at the furniture, scowling at the rugs. Jane might have a plan. Any plan. The whole thing seems wrong. The wrong slant. The wrong angle. A machine that thinks. What is thinking? Got to get basic about it. Very basic. They're too loaded up with tubes and connections. Need Jane around.

Slowly he felt the pressure of responsibility settling over him. Kayden, the fall guy. The stooge. When would he see Jane? Two months. And then it wouldn't be like being with her. Chaperoned!

He left the pre-fab and started to walk. The area was brilliantly

floodlighted. After sixty steps a guard stopped him and sent him home. He told the guard that he was in charge of the place, but the guard rested a hand lightly on the deadly air gun and said that no exceptions were made and that the guard detail answered to the War Department, not to the Head of Project.

Two weeks later and twelve pounds lighter, Joe Kayden sat at his big desk in the executive offices and wrote his fifth letter to Jane. It was the third time he had written the same letter. The first two versions had been returned because of matters touched on which concerned the Project. Jane's letters to him carried so little real news that he suspected that she was having the same trouble, but, of course, would not be permitted to say so in a letter.

She was living in El Paso, where she had found an apartment, and she missed him and she was looking forward to seeing him in New York when he got his first leave.

He puzzled over his letter, trying to find some acceptable way of telling her that he was getting no place on the Project. He watched the shaking of his own hands as he lit another cigarette. He wondered how long he would last—whether it would be better to fake a mental upset as soon as possible. But the thought of the shock treatments scared him. There might be a subsequent personality change which would alienate Jane.

At last he wrote, "I'm very, very happy here, and things are going very, very well. I'm as happy as I told you I'd be when we parted."

The next morning he had her answer. "Darling, I'm so glad that you're happy," she wrote. And then she ignored the entire matter. She babbled away about how she felt that her letters were probably "engramatical", about how she had played tennis and that the girl she met kept putting "lobes" over her head, about how she was enjoying the "frontal" apartment, about a new three-di movie she had seen about a "Woman of Syn", about how she had been looking over some of her old school "thesis".

He felt a quick wave of pity. Jane was trying so hard to be gay in her letters, but he could see that she was going to pieces. Her spelling was usually perfect. He shoved her letter into the top drawer of the desk, and sat, brooding, cursing the fate that had stuck him into the Project.

After lunch he re-read her letter. Its absurdity struck him again. Surely Jane knew how to spell "sin". Jane had a fine neurological education and had had two years of advanced psychiatric nursing.

As he read the letter he took a pencil and circled the obvious errors in spelling. Wald came in and said, "What are you doing?"

"Oh, the wife wrote me and I think she's going to pieces. Look at the mistakes."

Wald picked the letter up and glanced at the circled words. He frowned. "Joe, does she know any neurology?"

"Why, yes! Why?"

"Look at this. Engram. Know what this is? A lasting trace left in an organism by psychic experience. And look at this! Frontal. And over here is lobe. Add syn to thesis and you have synthesis. Hey, this is a code, Mr. Kayden!"

Joe snatched the letter. "What?"

"I'll have to report this to security, Joe."

Kayden glanced up at him. There was no trace of expression on Roger Wald's gray face. "You will?"

"Certainly. I'm going to write

a detailed report. I certainly hope I won't forget to send it over to them. Would you like me to get you a good text on neurology?"

Kayden saw the flicker in the gray eyes. He grinned. "You're O.K., Roger. Yes. Get me a text."

At three in the morning, Kayden finished the book and tossed it aside, turned out his light. But he couldn't sleep. Jane had been the first one to make sense. She had guided him to the heart of the problem. A mechanical approach to thinking. When he did fall asleep, it was to dream of her.

Dr. Zander stood up behind his desk and said firmly: "It is unthinkable, Mr. Kayden! An absurdity!"

"You just work here, Doc. I know what I want."

"You want to run a kindergarten, yes?"

"Possibly. I said to turn off the juice to all your gimmicks. Now listen to what I have to say. What are the two processes in the human mind that we're trying to duplicate? We're trying to build engrams, habitual pathways through the mind. Also, we're trying to create a process of synthesis. Do you agree?"

Zander sat down and said, sullenly: "If you say so, Mr. Kayden."

Kayden suddenly leaned across the desk and fluttered a paper out of the line of Zander's vision. Zander turned his head quickly.

"You see what you did? When you saw motion out of the corner of your eye, your nerves told the muscles of your neck to turn your head. You didn't think about it. That's an engram, an habitual pattern a mile wide. It would take conscious and hard thought to keep you from turning your head. Does an infant? No. The engram is developed. Listen to me—and stop acting so sullen and superior.

"Take synthesis. In cases of anxiety neurosis, the patient can make no decisions. He thinks of all possible eventualities and they frighten him. Some psychopaths think of no related fact except the one they have in their mind at the moment. In the first place, there is too much synthesis. In the second place there is too little.

"Combine those two factors. Suppose you had a machine into which you built, through varying strengths of electrical current across a field, varying factors of resistance, the faculty of being able to find a path of least resistance depending on the circuit where the electrical impulse started. If your chemists could devise some sort of molecular memory factor, you would have a continually decreasing resistance across this hypothetical field for certain standard questions. In other words, engrams! Don't you see? Habitual thought patterns! Any new item would have to find its own way across, but the old ones would have an established channel."

Zander looked faintly interested. He said: "I think I see what you mean, but—"

"Now add the quality of synthesis. I can think of one way to do it. Use a shifting ratio. Each

fact stored in the machine's memory is given a ratio number. Through a sliding value scale, you can alter the ratio numbers in the same way that they affect the problem at hand. For example, the machine may know something about rabbits. If the question you ask the machine, the task you set for it, concerns the orbit of Uranus, then rabbits would get a ratio number of zero. If you're talking about waltzing mice, rabbits might have a distant bearing and get a very small ratio number. If you're talking about lettuce, rabbits might have a high ratio number. You people should be able to figure out some method of making the ratio numbers plus and minus. Then, in effect, the machine could add up the pro side, the con side, and arrive at a decision. The decision arrived at would set up the beginning of an habitual pattern across this field I was talking about, thus eliminating some of the processes when a related question is asked. Tell me this, Zander: Do you know what I'm talking about?"

Zander examined his pink, dimpled knuckles. "In a way, I do. It is . . . is very new, yes? Hard to adjust oneself."

"Natürlich, my friend. But if your technicians can work it out, it would be beautiful. Just imagine. With any question asked of it, the machine would be able to call on all the vast stored knowledge of the ages, go through the weighing motions, and come up with an unemotional answer. That would be creative thought, because the new is always born from the old. We even had the wrong slant on creativeness. There isn't any such thing. It's all a question of engrams and synthesis."

Zander said, "So for this . . . for this dream of yours, you want everything we are doing scrapped? You want us to start from scratch with nothing but our developments in memory storage facility?"

"I want you to do just that."

"You have my verbal resignation. I'll confirm it."

Kayden leaned back in his chair and smiled at the ceiling. He said softly, "Citizens of North America. Today Dr. Artur Zander resigned from the Thinking Machine Project. Joseph Kayden, in charge of the Project, has announced that, with success in sight, Dr. Zander resigned because of petty jealousy, because he didn't wish to take orders from a man with fewer degrees than he has. Dr. Zander attempted to refute this statement, but in view of the record of failure of the Project during the time that Dr. Zander—"

"Wait, Mr. Kayden. I have been thinking, and possibly there is more in what you suggest than I at first realized and I would—"

Kayden grinned at him. "Doc, I don't want to force you. I want you to work for me because you want to work for me. How about it? I'll let you resign and I won't say one little word. Of course, it'll be tough for me trying to bumble along with men who don't have your background."

For the first time, Zander gave

him an almost human smile. "I stay."

Eleven weeks later Wald stood in Kayden's office saying, "Joe, why don't you go down on the floor. They should be running the first test. They were hooking up when I went by."

"Why should I?" Kayden snarled. "If it works, a grateful government raises my pay and keeps me on the stinking job of managing the monster. If it doesn't work, I'm stuck here until it does. Heads you win; tails I lose. Why don't you go down?"

Kayden sat alone as dusk gradually misted the office, hazing the sharp edges of the furniture, obscuring the picture of Jane on his desk.

The door opened and Dr. Zander walked in. He didn't say a word. He stood in front of the desk. Kayden switched on the light and saw to his surprise that tears were running down Zander's cheeks.

"So it didn't work," he said dully.

In a monotone, Zander said: "The first question asked was: 'What hath God wrought?' The answer was vocal. After a few seconds it said: 'There is no adequate definition of God except that He must exist in the spirits of men, in their hearts and minds. Man, this day, has completed a machine, a device, which, in its mechanical wisdom, will help Man to clarify and explain his environment. But the machine will never supplant the mind of Man. The machine exists because of Man. It is an extension of the inquisitive spirit of Man. Thus, in one sense, it can be said that God, as the spirit of Man, has builded for His use a device to probe the infinite.'"

Kayden couldn't speak. He licked his dry lips.

"Some of them screamed and ran from the room. Some of them thought that it was a trick of some sort. To the rest of us the Machine is already a personality. And yet nothing that it said was emotional. It was factual. The question was asked. It dipped into its store of knowledge and came up with the simplest and most direct answer. The thing knew that it had been built. It knew that it existed. Its existence is a fact. Its own recognition of that fact is something that I hadn't anticipated."

Kayden suddenly saw how shaken Zander was. He came around the desk and took the older man's arm. said gently: "Sit down, Artur. Let me get you a drink."

Zander drained the glass in three quick gulps, set it on the corner of the desk and grinned up at Kayden. All of the man's pretense was gone. He was humble. "You did it," he said simply.

It brought back the sense of loss. "I didn't do it," Joseph said bitterly, "my wife did it. My wife that isn't considered acceptable to come into this place."

"You miss her, don't you?" Zander said, his voice soft.

Kayden jumped up. "Now we've got to demonstrate this thing. I'll get hold of our bevy of angels and we'll give it a coming-out party.

Make it for tomorrow afternoon, or the day after. You fix up a list of questions, Dr. Zander, and I'll have Roger fix up the surroundings. Can we move the mike and the amplifier around? Good! We'll wire it for the main assembly hall. Building K. And by the way, get the voice of the monster as deep as you can and slow it down a little. I want it to sound like one of the major prophets."

At five o'clock the assembly hall was filled. The President of the United States of North America was present, as were two score of congressmen, a hundred scientists, dozens of minor officials. After Security had cleared the questions to be asked, the President was given permission to invite Ming, Dictator of the Federated States of Asia, as well as Follette, Ruler of Europe, and Captain Anderson, King of the States of Africa. South America was not represented.

Kayden sat with Roger Wald in the front row. At the appointed time, Dr. Zander walked out from the wings, turned and faced the men who sat in the audience—the men who ruled the world. A switch was turned on and a very faint hum permeated the air. All eyes were turned toward the immense amplifier that filled half the stage.

Zander faced the amplifier and said, into a small microphone: "What hath God wrought?"

In a slow voice of thunder the amplifier gave the answer that Kayden had heard in his office. He turned in his seat and looked at the faces of the men, saw there both fear and uncertainty—and a strange pride, as though each of them had had a hand in the making of the voice that spoke slowly to them.

"When will Man reach the stars?" Zander asked.

After a short silence, the Voice said: "It is possible now. All the necessary problems have been or can be solved with present methods. When sufficient money is given to research and development, space travel will become immediately possible."

The next few questions concerned problems that the physicists had not yet solved. The machine answered two clearly and, on the third, said: "The synthesis of all available data does not provide sufficient basis for an answer as yet. But there is validity in the assumption that the solution will be found by experimentation with the fluorine atom."

Kayden glanced at the list in his hand and saw that Zander had asked the last question. To his surprise he heard Zander say, "The development of the Thinking Machine has been a process surrounded with secrecy because of its possible use in warfare. Will the machine help in the event of a war between nations?"

During the long pause before the question was answered, a man jumped up and yelled, "Turn it off!" He was ignored. The representatives of the nations sat, tense and expectant.

The deep voice said: "The Thinking Machine will help in warfare only in so far as it is possible to

utilize some of the scientific advances made possible by the Thinking Machine. However, this is not a valid assumption. Warfare should now become avoidable. All of the factors in any dispute can be given to the Machine and an unemotional fair answer can be rendered. The Machine should not be a secret. It should be duplicated a score of times and made available to all nations. Thus can disputes be avoided. The effort to enforce secrecy is barren effort. Secrecy in the case of the Machine accomplishes nothing."

Zander turned and walked from the stage. The humming stopped suddenly. The assembly hall was silent. The rulers of nations looked at each other and in their eyes was a new promise of trust, of acceptance.

Roger Wald was whistling as he came into Kayden's office. "The bans are lifted today," he said happily. "Come and go as you please. O fine and happy day! When does Jane arrive?"

"At four."

"Good. You'll get cocktails at your place at four thirty. I'll have them sent over."

Wald turned to go. "Wait a minute, Roger," Kayden said. "I know I owe Zander for the fact that the security measures are done with, but what on earth ever got into him to ask that question?"

"Didn't he ever tell you? He must be shy. He and I were working late on the setup, and just for the hell of it, he asked that question. You see, he and I had been talking about you and your busted home life. We liked the answer so well that he decided to use the question in front of all the folks."

Wald left the office. Joseph Kayden glanced at his watch. Two fifteen. Just one hundred and five more minutes. He walked into the silent, empty assembly hall and turned on the amplifier. He grinned and said into the mike: "Does she still love me?"

There was a few seconds of silence. Then the Machine boomed, with what was almost irritability: "Does who still love whom? The question must be specific."

THE END.

THE ELECTRICAL ROBOT BRAIN

BY E. L. LOCKE

***A two-part** article on one of the most intriguing developments of our day, the fire control computer. Designed to make the course of a shell intersect the flight of a plane, it is, in essence, a working model of a spaceship's automatic flight computer! Replace "target" with "Mars," and the device could solve for the flight-course!*

Part I

It was quite a while ago that writers of science fiction introduced into stories of space warfare the notion of automatically training guns on moving targets. While these stories perforce skipped over the details, the principles suggested appeared feasible. Eventually reality caught up with fiction but it took a major world disturbance to do it.

Most of us remember the inner feeling of dismay at the way the Nazis, aided powerfully by their Stukas, swept all before them in the spring of 1940. Many felt sure that the war was bound to come our way and wondered how they could help prepare for the inevitable.

One such man was young David Parkinson of the Bell Telephone Laboratories. The story may be apocryphal, but it is said that one night he had a vivid dream that he was a member of a Dutch antiaircraft battery. This outfit possessed a marvelous robot mechanism which tracked the Stukas, digested the information thus obtained and then passed on its well considered judgment as to the aiming of the guns. The precision was uncanny and the Stukas were falling like dead flies.

The possibilities of such a robot were so attractive that the idea was studied in detail. Surprisingly, it was found to be akin to the communications problem. That is, it involved the reception, transformation and transmission of continuously varying data. Hence it was quite natural for the Bell Telephone Laboratories to develop it and thus translate into reality what started as an extravagant dream.

The project was officially initiated in November, 1940. It wasn't long, as such matters go, before an ex-

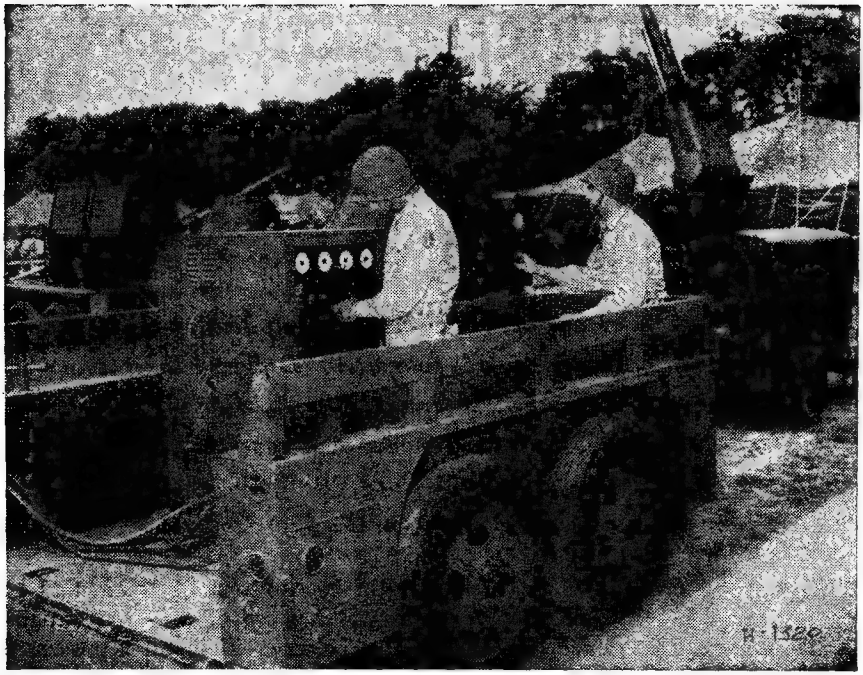


Fig. 1. The M-9 fire computer on station. The computer itself, with dials for setting in air pressure, wind, the other "given conditions" in the foreground. Background left, power supply truck. Background right, launching device for suicidal robots—VT fuzed shells!

perimental model was tested and accepted by the Army. The production design was standardized by the Army in February, 1942, and the first model came off the assembly line on December 12, 1942. This was the famous M-9 Director which automatically controlled the fire of a battery of four 90 mm guns and its five less well-known brothers used with guns of other calibers.

The M-9 saw its first use at Anzio. The Luftwaffe had itself a fine time attacking the exposed beachhead both day and night. One night a few batteries of guns and their M-9s were rushed to the beach and set up in a hurry. The next attack was in for the surprise of its life. According to a carefully verified count, six hundred ninety-one planes were shot down! The Luftwaffe then decided that is was healthier to stay away from this particular beachhead.

The climax really came at the last battle of London and again at the defense of Antwerp. Appropriately enough, our robot was matched against another robot, the V-1. What happened is a story worth telling in some detail.

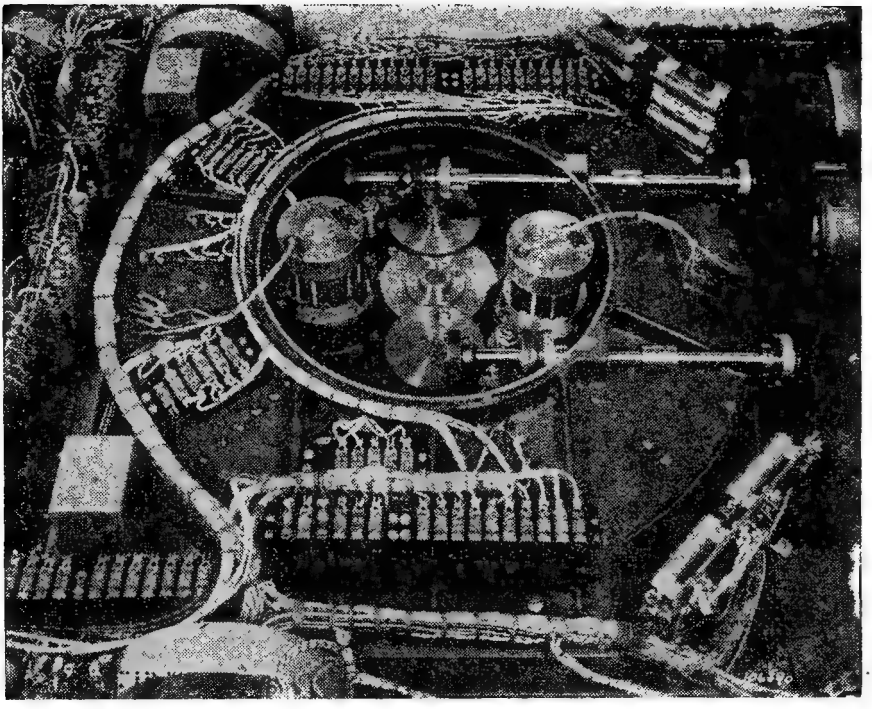


Fig. 2. Inside the fire computer. Perfection of theory would be useless without excellent precision workmanship. The problem of orbit astrigation is essentially the same sort of path intersection this machine worked out.

When the defense of London was first set up by the Air Ministry, the plan of defense was that shown in Figure 1. Just outside London there was a ring about five miles deep in which the barrage balloons were anchored. Outside of this was a second ring, about ten miles in depth, in which were located the AA defenses. Finally, from here out to over the channel the defense was entrusted entirely to the fighters.

The guns were under a grave handicap because of the severe restrictions placed on them as to what conditions had to prevail before they were allowed to fire. For instance, they were never permitted to fire unless the target could be seen visually and no fighter was attacking it. As a result, the guns got only eleven per cent of the V-1s launched, the fighters thirty per cent, the balloons five per cent, thirty per cent went astray, while the remainder hit the metropolitan area.

This went on for about three weeks when the Air Ministry decided to change the plan of defense. The guns were moved out to the

coast and were permitted unrestricted fire over a zone starting five thousand yards inland out to ten thousand yards over the channel. The fighters operated outside of this zone and so they really had the first and third cracks at the V-1s. This shift in plans really produced results. By the end of the first week the guns' score had increased to seventeen per cent, then as the gun crews got better in the handling of their equipment, their score continued to improve. At the end of the second week the score was twenty-four per cent, the third twenty-eight per cent, the fourth forty per cent, the fifth fifty-four per cent, while in the sixth and last week it was seventy-four per cent. The fighters averaged ten per cent, while the balloons got two per cent.

As a result of this showing, it was decided to entrust the defense of Antwerp solely to AA. Our robot really went to town here. With no restrictions placed on firing, out of four thousand eight hundred eighty-three missiles engaged, four thousand six hundred seventy-two or ninety-five point seven per cent were shot down. To finish the job off in style eighty-nine out of ninety-one were brought down on the last day.

It has been said by some that the V-1s were easy targets. This does not agree with the opinion of the Air Ministry. Its experts point out that this missile was about eight times as hard to kill as a piloted airplane flying the same course. The V-1 was quite small, its construction was extraordinarily rugged, and it had a notable lack of vulnerable components.

As a sort of a postscript, we may note what happened at Remagen Bridge in the last days of the war. Out of four hundred forty-two sorties flown by piloted aircraft, two hundred were shot down at the expense of only three thousand two hundred twenty-six rounds fired. Contrast this figure of sixteen rounds per kill to the World War I figure of seventeen thousand!

The Operational Problem

In order to appreciate what the director-gun team was up against, let us take a quick look at the problems faced by the antiaircraft defense of a vital point. In defending such a point against piloted aircraft it is important to get the bombers before they drop their eggs, or at least to disturb their aim. Now since a bomber which is flying at, say, thirty thousand feet altitude with a speed of 400 m.p.h. releases its bombs when about twenty-five thousand feet horizontally from the target, it will be seen that if the guns are located near the target they must open fire near their extreme range, say at forty-five thousand feet horizontal range. It may be suggested why not put the guns farther out. This is a fine idea, but since the range of the guns is limited, the farther out the guns are, the more you will need, because the enemy may come in from any point of the compass, or from

several for that matter. This is called saturating the defense.

Since in war time there is never enough of anything, it is important that the utmost be squeezed out of the equipment. This means that guns and the information supplied to them must be accurate at extreme ranges and at all angles of fire, from below the horizontal to the almost vertical. It means that when one bomber is disposed of the next victim must be picked up in a hurry. The director must be able to forget its old information and assimilate the new in a matter of a very few seconds.

All this wouldn't be too bad if the shells only had decent speeds. The old bromide "fast as a bullet" just doesn't mean a thing. When a shell gets toward extreme range it is pretty tired. Surprising as it may seem, average shell speeds run only about 800 miles per hour, which is not enough for comfort. In fact, things are so bad that firing is confined to the incoming leg of the course where the shell and target speeds add. Once the target is on the outgoing leg, you might as well stop firing. The chances are that the shells you send after it will never catch up. Yet despite these handicaps, the record is impressive, as borne out by the figures cited.

The Mathematical Problem

As originally designed, the M-9 Director consisted of two main components: the optical tracker and the computer. The tracker, as its name implies, has the function of following the motion of the target and passing this information to the computer. However, the rapid development of high precision tracking radars relegated the optical tracker to a standby function. Therefore no more will be said of it here, and in further discussion the presence of a radar will be assumed.

The radar measures the slant or air line distance to the target. In the process of tilting its antenna, the orientation of the radar beam in space is obtained in the form of two angles. Thus the location of the target with respect to the radar is measured continuously, since once the beam fastens on the target, it will hang on like a bull dog, or shall we say a tractor beam?

The computer takes this information, notes how it varies with time, and calculates from this the velocity of the target. Since the radar data has some small but annoying fluctuations, the computer first "smooths" out the velocity data, and then makes a prediction of the lead the gun should be given so that whenever it may be fired the shell will hit the target. This information is then automatically and continuously transmitted to the gun. Thus the gun also moves continuously and may be fired at any time. In fact it is fired as rapidly as it can be loaded.

In its full glory, the making of a prediction is quite an involved process. While essentially it amounts to a correlation of the target's motion with the ballistics of the shell,

FIG. 1: ORIGINAL DISPOSITION OF LONDON'S DEFENSES AGAINST V-1

a number of complicating factors are present, which if dragged in by the ear would complicate this presentation unduly. The basic principles, however, are quite manageable.

Let us see how we can go about making this lead prediction. Visualize a radar at some point on the ground and the target at some point in space. Assume that the target is flying along a straight line course at a constant but as yet unknown speed. Now if the radar beam is fastened to the target, we know at once what the air line or slant distance is from the radar to the target. Furthermore, as mentioned previously, the radar antenna has to be rotated into the proper position so that the beam can hold on to the target. But rotation is a relative term, and since the amount of this rotation gives two of our basic data, each just as important as the slant distance, we must define it carefully. This is easy enough.

Assume that just prior to the engagement, the radar beam is horizontal and points due north. When the target is sighted, assume that the antenna is first rotated about its vertical shaft until the center line of the beam is directly underneath the target. Once there, the antenna is next rotated about its horizontal axis thus lifting the beam off the ground, until its center line passes through the target. The first rotation thus measures an angle in the horizontal plane while the second rotation measures an angle in a vertical plane. These angles are respectively called the present azimuth and the present elevation of the target.

The three data which the radar has given us for fixing the present position of the target are now in what are called polar co-ordinates.

It is, however, more convenient to deal with three distances rather than one distance and two angles. Therefore, the data is converted into three equivalent rectangular co-ordinates. One of these is simply the height of the target above the ground, that is, its altitude. The other two are merely the distances from the radar along the north-south line and the east-west line. These are called the Y and X co-ordinates, respectively, and are easily obtainable from the polar data by using a little trigonometry on Figure 2.

Now what about this matter of finding the speed of the target? Suppose that the target is flying on a straight line with constant speed and that we follow up on its motion continuously with the radar. Furthermore, we also continuously convert the data it gives us into the equivalent co-ordinate distances. If we keep track of these three distances, it will be observed that each component of distance increases uniformly with time. This is merely another way of saying that the target velocity can be considered to be made up of three component rates, each of which has its own constant value. One component is along the vertical direction and the other two are along the X and Y directions respectively.

From this we immediately infer the happy fact that we can estimate where the target will be one second or thirty seconds or any other reasonable time from now. That is, we can predict its position in the near future, once we have found these rate components. For instance, if we want to know where the target will be along the X direction thirty seconds from now, and if this particular component rate is one hundred fifty yards per second, that is, three hundred m.p.h., all we have to do is to multiply 150 x 30 and add this to the present value of the X co-ordinates. Similar statements hold for the other two directions.

Let us leave the target for the moment and consider the gun. It will be convenient to assume that the gun is at the same spot as the radar. This, of course, is done here for the sake of simplification. In the actual director due allowance is made for the separation.

Now suppose we elevate the gun barrel off the horizontal, fire a shot and observe the position of the shell, say each second after it has left the muzzle. We notice that the shape of the trajectory is roughly parabolic and that its initial direction coincides with the direction of the gun barrel. If we repeat the firing for different elevations of the gun, we will get a sheaf of trajectories like those shown in Figure 3. (For security reasons, the data shown is for a foreign gun.) If we connect the points corresponding to the same value of time, or time of flight as it is called, we get a pattern of approximately elliptical lines. The fact to note is that, given the elevation setting of the gun and the time of flight, we can find from such charts or their equivalents how high up the shell will be and how

far it has traveled along the horizontal.

From the practical standpoint, the converse is also important. Namely, if we want to put a shell through a point having a given altitude and ground range, there is a unique gun elevation and an equally unique time of flight corresponding to it. (You ex-mortar men need not jump on me. I know that there may be two trajectories which will pass through the same point, but remember, one of them will have a much longer time of flight than the other. It is the shorter time of flight that is of interest in AA gunnery.)

Now let's put the pictures of the target and the gun together into a single frame. Suppose in Figure 2, we spot the point on the target path where the target will be one second from now. We next calculate the altitude and ground range of this possible future position. Now we enter the chart of Figure 3 with this pair of values and estimate from the time-of-flight labels on the ellipses how long it would take the shell to get to this one-second point. The chances are that it will be a good deal more than one second. Consequently, we would not fire toward this particular point because the target will have left it far behind by the time the shell got there.

Well, the one second having been a bad guess, we next try two seconds and repeat the calculation. Very likely we will fail again and so we keep trying different values of time until we hit the mathematical jackpot. We will know when we hit it by the fact that the time of flight of the shell corresponding to the altitude and ground range of this particular future point agrees with the time we reckoned ahead.

All this assumes that the target is getting nearer the gun. In this case, it can be proved that, providing the gun has enough range, such an impact point always exists. If, however, the target is flying away from the gun and it has any decent speed at all, then in all probability no such impact point will exist. Physically, the reason for these statements is that on the incoming leg of the course the target and shell speeds tend to add while on the going away leg they subtract. Hence there is an excellent chance that in the latter case the shell will not catch up with the target. It is for this reason that experienced AA gun crews will not fire on a target that is going away.

The essential point to bear in mind then is that associated with the present position of the target there is a perfectly definite future position which the target will reach in exactly the same time as the shell which is fired at this instant toward this specific point. The basic mathematical problem is, therefore, no more and no less than the locating of this point along the target path.

Now from what has been said, it is clear that the location of this point is a complicated function of the target's speed and direction and the ballistics of the gun. To cal-

culate it, a skilled human computer using a high speed desk calculator would need about twenty minutes per point. But time waits for no man and neither does an enemy bomber. Hence the need for a robot which can quickly solve the problem and which furthermore will give a continuous and precise solution. This one can start from a completely wrong answer when the target is first picked up and in a few seconds settle down to the routine of grinding out the correct answers. Curiously enough, it acts as though it had an inner urge to get the right answer. The farther the mechanism is from the true answer at the start, the greater will be the forces which drive it to the right one. Once it settles on the true answer it will move only enough to maintain it as the target position changes.

Furthermore, the answer has to be precise, as a simple example will

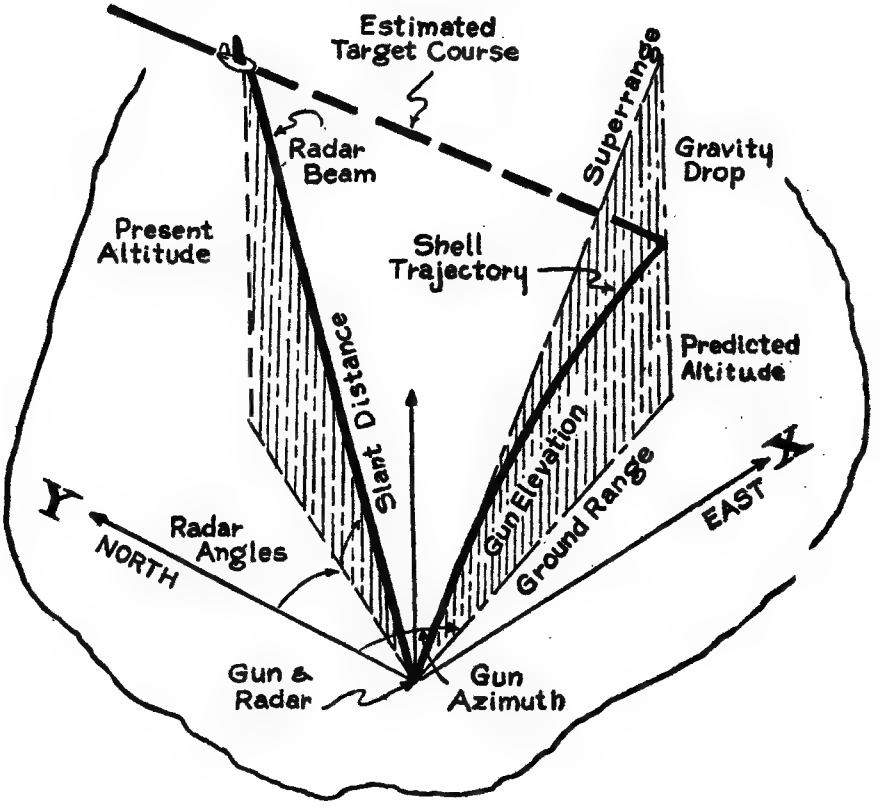


FIG. 2: GEOMETRY OF THE A·A· PROBLEM

show. Suppose that the target is coming in directly toward the gun at four hundred m.p.h. and that we will fire at it so that it will meet a shell which has had a thirty second time of flight. A rough computation from the data of Figure 3 shows that the gun should be fired when the target is about sixty-six thousand feet or twelve and one half miles from the gun. At the impact time, which will be thirty seconds after the gun is fired, the target will be about forty-eight thousand feet or somewhat over nine miles away. Hence the gun had to be given a lead of eighteen thousand feet or about three and one third miles! Since the lethal radius of the shell is about fifty feet, we can visualize the precision required to get a hit.

Now that we have seen the basic problem in its entirety, let us look at the ballistic aspects a little more closely. It turns out that altitude and ground range are not convenient variables for describing the trajectory data, at least for use in our computer. Let us, therefore, look for another way to describe the possible shell trajectories.

If we could attach an antigravity screen to the shell, it would travel in a straight line in the direction of the gun barrel or, as it is technically called, along the line of departure. Its rate of travel would not be uniform because the air drag slows it down. However, it is perfectly possible to calculate how far the shell will have traveled along this line for any particular value of time and for any particular angular inclination of the line of departure with the horizontal. The latter factor makes some difference because the density of the air varies with altitude. Distances measured along this line are called superrange. Geometrically, superrange is the length of the line GF in Figure 2.

Unfortunately, antigravity screens are not yet available, and we must do battle with that old debbil, gravity. Gravity pulls down the shell from the line of departure, but not quite as the well-known law of falling bodies would have us believe. Again the density of the air comes in and slows the fall. However, it is once more possible to take all factors into account and calculate this gravity drop or, as it is more euphoniously called by the military, superaltitude. Geometrically, this is the length of the line FH in Figure 2. Hence we may choose to regard the actual position reached by a shell on some trajectory as having been compounded of two hypothetical and distinct motions, first a motion along the line of departure followed by a second motion straight down, due to gravity. Of course, there are many other equivalent ways of describing the trajectory, and in fact, the system of description that our computer uses is slightly different from the one described here. However, there is not much to choose between these alternative ways, and for purposes of discussion the one described here will do quite well.

The actual calculation of super-

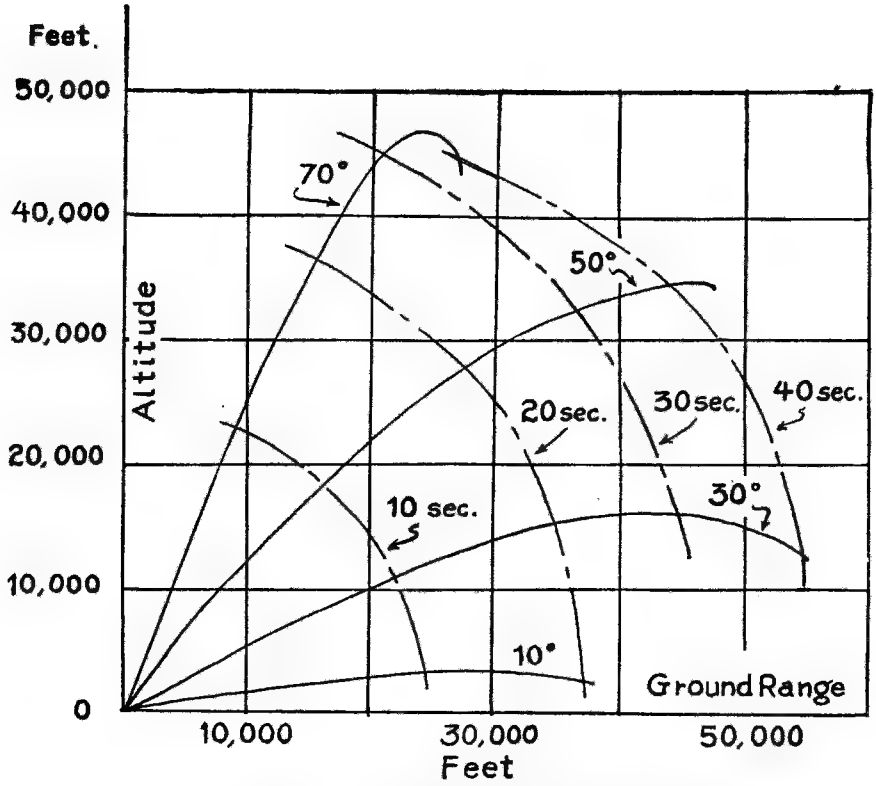


FIG. 3: TRAJECTORY SHEAF

range and superaltitude if we have ground range and altitude data is a matter of simple trigonometry which can be easily derived from Figure 2. The results of the calculations are plotted in Figure 4. It will be noticed that in contrast with ground range and altitude the values of these quantities depend principally on the time of flight and only secondarily on the angle of departure. This is what makes them useful for our robot computer.

Now that we have these quantities we can dispose of a problem that has been kept purposely in the background. Suppose we have found the right point on the target path for which the travel time of the target just equals the time of flight of the shell. How do we aim the gun so that the shell will get to the right point? The answer is something like this. Imagine that the target has been moved upward from its true future altitude by the amount of the gravity drop of the shell. Point the gun so that the center line of the barrel passes through this hypothetical jacked-up

target and there you are. The gun is now pointed correctly, not only in elevation, but also in azimuth.

The mathematical attack on the problem described up to this point is about the way a human computer would go about his calculations for purposes of computing points for a production test. However, we cannot yet build verbal descriptions into a robot. We have to put his instructions in the form of definite circuit configurations. This is merely another way of saying that we must first formulate the equations which are equivalent to the verbal description given and set up the right kinds of circuits for solving them. So the next thing to do is to describe the kinds of equations that the robot has to handle.

Starting with the radar, we need three equations which will convert the polar co-ordinates of the target into rectangular ones. Next, from the way these co-ordinate distances vary with time, we must calculate the three component rates. The mathematical operation is that of differentiating the co-ordinate distances with respect to time.

Up to this point we have talked as if there were two distinct time computations going on. One of these was choosing a tentative value of time for which we reckoned the future position of the airplane. The other kind is the calculation of the time of flight of the shell. Actually, the computer works exclusively in terms of the latter. What it does in a general sort of a way is to set up a tentative value of time of flight and uses it throughout all the computations that go on simultaneously. It does a similar thing with gun elevation. In point of fact these tentative values at the start are merely the values that have been left in the machine from the previous run.

Using these "left-over" values, the computer calculates superrange by two distinctly different methods and compares them. In this process it generates a value of gun elevation, and this also is compared with the "left-over" value. If the results do not agree, it is forced to choose another value of time of flight and gun elevation, the choice being controlled by the sizes and signs of the discrepancies.

The mathematical processes then conform to the following scheme. Each of the three calculated rates is multiplied by this "left-over" value of time of flight and the resulting three leads are added to the respective present position co-ordinates. This gives the co-ordinates of a tentative future position of the target. The two horizontal components then determine a tentative ground range.

Now the computer looks into its table of data giving the gravity drop or superaltitude. This is a double entry table because this quantity depends both on time of flight and gun elevation, as Figure 4 shows. The table is entered with these "left-over" values of time of flight and gun elevation. The computer notes the corresponding value of the gravity drop and adds it to the tentative future height it

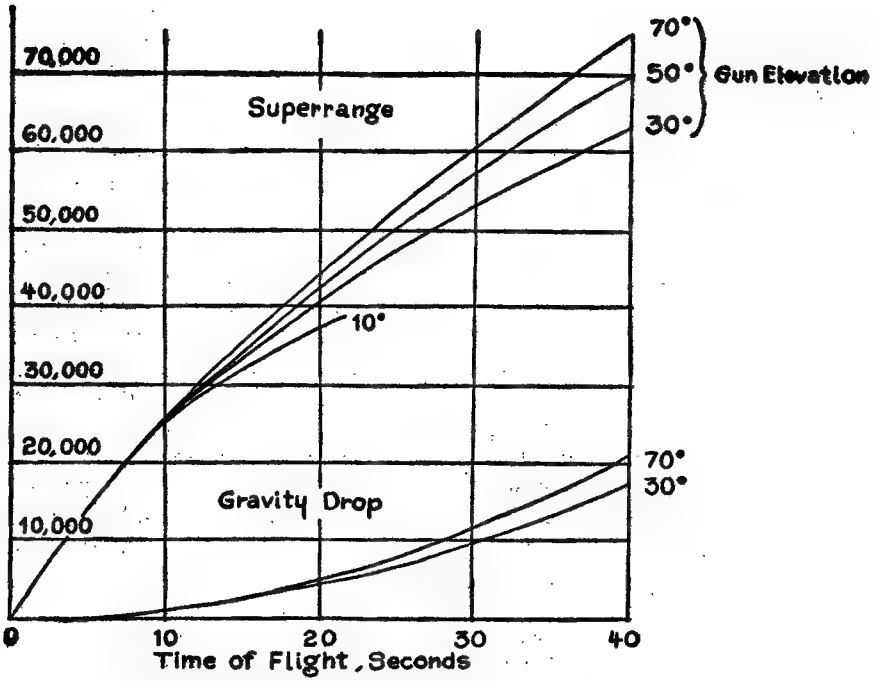


FIG. 4: BALLISTIC DATA

has just estimated. This forms one leg of a right triangle whose other leg is the tentative ground range. The hypothenuse then represents the first estimate of the superrange.

The base angle of this triangle represents an improved estimate of the gun elevation. In this case the comparison is immediately available because this base angle can be compared with the "left-over" value of gun elevation.

Now comes the final pay off. Can the computer estimate the superrange by a second method? The answer, of course, has to be yes, otherwise this success story could not have been written. The reader will recall that a little earlier we have established that superrange was calculable directly from the time of flight and gun elevation and that, as a matter of fact, we have plots of it in Figure 4. Therefore, what the computer does is to enter its double entry table of superrange data with the "left-over" values of time of flight and gun elevation and sees how well this second value agrees with the first. If the disagreement is large, the time-of-flight circuit is given a violent shove. If small, it gets a more or less gentle nudge. Since a comparison is also available for gun elevation, this circuit is also being pushed or nudged at the same time.

While we have described these processes sequentially, actually they all go on simultaneously. Thus the time of flight and gun elevation circuit settings are being continuously adjusted until they are brought to the correct point. Thereafter, since the speed of the target, though high, is nevertheless small compared to the speed of response of the circuits, the solution is kept on the nose through a series of very gentle nudges as the target gradually changes its position and new data is being fed to the computer.

There is one more piece of data needed explicitly, namely, the gun azimuth. From Figure 2, this is seen to be the inclination of the ground range line with the north direction. This angle is changing continuously as the time-of-flight circuit adjusts itself. When the latter has settled down, the azimuth circuit will also have settled, thus giving the last of the unknowns.

TO BE CONCLUDED.

THE ANALYTICAL LABORATORY

Because of the length of the final installment of "Children of the Lens," we had only four fiction pieces in the February issue. The report on that issue follows below. And incidentally, just for curiosity's sake, I calculated the average point-score of "Children of the Lens"; the individual points scores have been 1.88, 2.00, 2.26 and this month 1.94, for an average of 2.02. The calculation is actually meaningless, because each issue is rated by your readers on a "in this issue" basis of preferences, and doesn't allow for exceptionally strong issues—or, all human things being what they are, exceptionally weak issues.

At any rate, the score for the record:

Place	Story	Author	Points
1.	Children of the Lens (IV)	E. E. Smith	1.94
2.	There Is No Defense	Theodore Sturgeon	2.11
3.	New Lives For Old	William Bade	2.94
4.	Cosmetics	John D. MacDonald	3.05

THE EDITOR.

SCIENCE FICTION BETWEEN BOARDS

BY P. SCHUYLER MILLER

The development of science fiction, seen as part of the whole stream of literature, in many ways parallels that of the mystery story. Both had their scattered early pioneers; both took on new stature in the early 1800s, the detective-mystery with Poe and science fiction also with Balzac, Mrs. Shelley, and Fitz-James O'Brien. Both flowered half a century later in Doyle's great creation of Sherlock Holmes and in the science novels of Verne and Wells. Both, in recent years, have been gaining acceptance as legitimate types of literature.

Although the Utopian novels and the many "fabulous voyages" give science fiction a much longer pedigree than the mystery novel, the latter has made up the handicap in the last generation. Most if not all of the serious book review journals now recognize that a mystery must be understood and judged according to rules of its own, and employ mystery specialists to review the new books in their field just as they assign specialists in poetry or the drama to judge those fields. Science fiction, unfortunately, has not yet achieved this stature, degree of acceptance, or whatever you may choose to call it. And as a result the spectacle of a run-of-the-mill critic trying to make sense out of a new science fiction novel is downright ridiculous when it is not painful. He may treat it as a ghost story. He may remember "Tom Swift" and consider it juvenile adventure. He may struggle to make a mystery of it, dismissing the plot as "farfetched" or "improbable". If the thing has been written by some literary big shot, it may be passed off as "original" with passing reference to Verne and Wells and to the atomic bomb.

Casting around for a straw to which to cling, Jonathan Q. Critic usually falls back on one infallible screening test. If a new science fiction novel is seeing print for the first time "between boards"—"in hard covers" seems to be a current equivalent—it must obviously deserve some kind of consideration, because publishers are supposed to know their business.

But if the thing can be shown to have come up the hard way, through the pages of a "pulp" magazine, it can be dismissed as trash.

If we pass over the "atomic-war-soon-with-Russia" books, which are really only a variation on the old-fashioned spy story—unless they are out and out propaganda—there are six recent science fiction novels in good hard covers which point up this double standard. Three are "classic" serials from this magazine, put between boards by three fantasy publishing houses. The other three have been brought out by orthodox publishers, perhaps as a bid for a share in the growing interest in science fiction.

Jack Williamson's "The Legion of Space" is now available at $3.00 as the second in the series of science fiction novels from Fantasy Press of Reading, Pennsylvania. It does not pretend to be anything more than a good space-adventure yarn in the swashbuckling tradition—and formula—of "The Three Musketeers". Williamson was one of the first of the young writers to respond when science fiction came of age in 1926 in the old *Amazing Stories,* and he has continued to be one of the best. Billed first as a poor man's Merritt, he was already developing his own literary personality when the first of the Legion triology appeared in Astounding in 1935. The Merritt influence is still there in the bright color and broad action of the space-wide struggle of wine-bibbing old Giles Habibula, sleek Jay Kalam, and massive Hal Samdu, with their young D'Artagnan, John Star, and the glamorous Alador against traitorous villains and alien races for the secret of AKKA. The book has the attractive, professional-looking format which is the earmark of Fantasy Press, although Donnell's illustrations are not as striking as his chapter-vignettes for E.E. Smith's "Spacehounds of IPC".

Hadley Publishing Company of Providence, Rhode Island, has brought out an edition of A. E. Van Vogt's "The Weapon Makers", also for $3.00, which is typographically better than its first two books but not even a close rival in binding or art work to its current rivals. The second of these is the Arkham House edition of Van Vogt's "Slan", out at $2.50 with a striking jacket by Robert Hubbell. It is to be hoped that August Derleth will select other outstanding science fiction novels for his list. Both Van Vogt stories were published here too recently to need a synopsis.

The three "pro" novels are an oddly assorted lot, but fairly representative of the kind of science fiction which seems to appeal to the general publisher. The first, "Adrift in a Boneyard," by Robert Lewis Taylor (Doubleday, $2.50) is a slapstick burlesque of the last-man-in-the-world theme. It fails to hold together as science fiction because the author either did not understand or was not concerned with the rules of logical development which Science Fiction readers consider essential. As a result, the book is often plain fantasy. In a sense, it is old-fashioned. The

author has seen no need to explain or even make probable the catastrophe with which, on the night of April 18, 195–, he wipes out the entire human race except for the six specimens whom he has selected to carry on the antics of survival. The nominal hero is Fred Robinson, a low-pressure advertising man with a Westchester home, a young wife, and an Irish maid who is further afflicted by a young varmint of a son. The menage is later increased by a pet tiger named Uncle Claude. The story tells half-logically, half-nonsensically of Robinson's struggles to make his little community self-sustaining and to find out whether there are other survivors. Two do turn up in the Mitteleuropan principality of Poderkagg—an octogenarian anarchist and his nine-year-old grandmother—and the Robinsons set out to find them. All this is very good fun and would be good humorous science fiction but for its lapses into fairy-tale episodes, such as the highly entertaining but incredible chapter in which the grateful animals of the Bronx Zoo—released by Robinson—come to the rescue in approved United States Cavalry style when the family is besieged by wild dogs.

Pat Frank's "Mr. Adam" (Lippincott, $2.50) is by far the best of the three books. It would be entirely at home in such a magazine as Science Fiction if it were not for the conventions which keep honest treatments of sex problems out of "family" periodicals. Briefly, every man in the world except gangling, carrot-topped, bashful Homer Adam is sterilized by the radiations from an atomic blowup—Adam was in a lead mine at the time. On this one unwilling male rests the responsibility for giving the human race a new start. Mr. Frank misses no opportunity to carry out the logical possibilities of the political, psychological, and physical free-for-all over this second Adam. He could have written just another dirty book, and would perhaps have sold more copies. Instead he has told a story which can be read as a joyous satire on American bureaucracy—as a somewhat uninhibited development of a standard science fiction theme—or for just plain fun.

The book which really awes the critics, however, is "Doppelgangers," by H. F. Heard (Vanguard, $2.75). Mr. Heard is otherwise Gerald Heard, the California philosopher and disciple with Aldous Huxley—of "Brave New World"—and other *literati* of a semi-pseudo-Hindic cult called Vedanta. Mr. Heard, the philosopher, brings to science fiction just the kind of long-haired respectability with which Willard Huntington Wright—as S. S. Van Dine—endowed the detective story, and the result among the critics is about the same. Most reviewers have been greatly impressed by the "originality" and "fresh imagination" of his book—and when you see those terms in a professional review, you can be pretty sure that the critic has come up against something he has never seen before, and doesn't know whether it is good or bad.

To be impolite, Mr. Heard—who

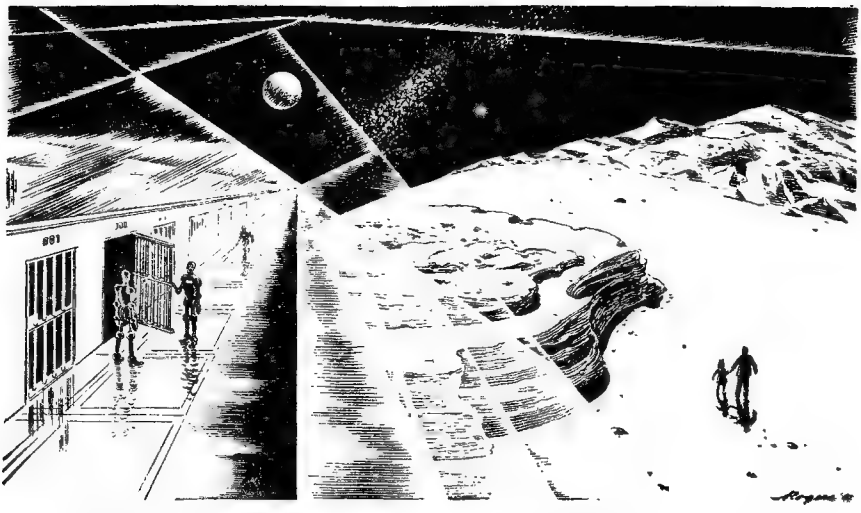
did much better a year or two back with his short stories in "The Great Fog"—has set up a situation straight out of any recent issue of Science Fiction—a well thought out world culture of 1997—and doesn't know what to do with it. There is an almost direct parallel in plot between "Doppelgangers" and Van Vogt's "Weapon Makers". The Heard book tells a story of a struggle for power—the "psychological revolution"—between the in-party of a highly regimented society, run by a mysterious dictator known as Alpha the Bull, and an equally totalitarian underground operated by his antithesis, Omega the Mole. A third corner to the struggle develops when a young man of the underground is made into a physical replica—the "doppelganger" — of Alpha, and is sent to take his place. Van Vogt's story shows another such three-way conflict with the Isher Empire, the Weapon Shops, and Hedrock in the corresponding corners.

There, unfortunately, the parallel ends. Van Vogt's story folds and unfolds with speed and smoothness, but Philosopher Heard pushes his story forward by setting up a series of big scenes which promptly degenerate into a mumble of mystical conversations dealing apparently with the inner meaning of the universe as revealed by Vedanta. One ponderous Hollywood stage-set, dripping with Vedantic symbolism, lumbers after another, but for the most part nothing else moves.

These last three books are typical of the kind of science fiction found between boards, outside the magazines. "Mr. Adam" has a sex-motive which would keep it out of general circulation. "Adrift in a Boneyard" is undisciplined burlesque, as much fantasy as science fiction. Finally, in "Doppelgangers", we have the Utopian theme, as acceptable to "good" literature as to our kind, gruesomely manhandled by an author who is more interested in preaching his own particular brand of heavy-handed mysticism than in telling a story or working out the consequences of his plot-structure.

By comparison, Van Vogt's two books seem to leave the average reviewer cold because, in common with most magazines of science fiction, they give their readers too much. The novice, the goop, the innocent critic can no more understand the full intricacies of their plots than a nonfan can appreciate the best modern puzzle-mysteries of John Dickson Carr. If science fiction is going to find a real place between boards, winning new readers among the general public, it will be with less involved, more realistic situations which take less for granted or at least more skillfully conceal what is taken for granted. When this happens, science fiction books will cease to be mere curiosities and find a place in modern literature comparable to the one which mystery writers have earned for their work.

THE END.



...AND SEARCHING MIND

BY JACK WILLIAMSON

***Last** of three parts. Perhaps a truly trained mind could conquer all things—save the one thing it can never assault; itself and its own misunderstandings!*

Illustrated by Rogers

Synopsis

Dr. Webb Claypool was only a distinguished astrophysicist, when the Crater Supernova flamed out in the sky. He and Ruth were on their honeymoon, the night he first saw it, but he broke their plans and hurried back to Starmont to make his observations. Ruth cried over it, and never understood. But he studied the cruel sudden splendor of the star, and found the clue he wanted—to the new science of rhodomagnetics.

That new science created Project Thunderbolt—a secret weapon whose self-guided missiles detonate matter into destructive energy. It also wrecked his digestion and slowly blighted his happiness with Ruth, because Project Thunderbolt became an intolerable burden.

Claypool was at work on those planet-shattering missiles in the underground launching station at Starmont, when a little girl spoke to him, and handed him an unexpected invitation to call on one "A. White, Philosopher."

The child escaped, without explaining how she had entered that secret arsenal, through the locked and guarded gates. Baffled, Claypool obeyed instructions in the note, to visit the abandoned Dragonrock Light. There he found the child, Dawn Hall, with White and three other students of psychophysics. White was a huge, red-bearded, angry man, grimly waging a strange war.

Dawn, White explained, came to Starmont by teleportation. Graystone, an alcoholic stage magician, is a telepath. Overstreet, rescued from a mental hospital, is clairvoyant. Lucky Ford, a shrewd-eyed little gambler, was manipulating his dice by telekinesis. White had gathered and trained this singular group, for his desperate crusade.

He was fighting the humanoids.

The humanoids, White warned Claypool, are small android mechanicals, driven and controlled by rhodomagnetic beams from the relay grid of a central mechanical brain on the far planet Wing IV. They were made to stop war. But their maker, an engineer named Sledge, built them too well.

"They're too efficient," White told him. "Too perfect, and too benevolent. They had spread from world to world, across the inhabited sections of the Galaxy, forever blindly obedient to the Prime Directive—To Serve and Obey, and Guard Men from Harm."

Overstreet's prevision, White warned him, had seen the humanoids coming here next—to protect this planet from the technological crisis caused by such discoveries as Claypool's. White had been developing mental weapons to fight the humanoids, but they were not enough, and he needed a rhodomagnetic engineer.

Claypool refused to join him, however, because of his responsibilities at Project Thunderbolt, and the new mechanicals arrived. They had promised to end war and crime and toil and want, and all unhappiness. But Claypool, when he returned to Starmont, found bitter disillusionment.

His great telescope had been demolished, because research is now too dangerous for human beings. Ruth had been given euphoride, a drug of forgetfulness, because she seemed unhappy. When he protested, the mechanicals suggested that his own memory ought to be removed.

There is one man, however, who likes the humanoids. That is Frank Ironsmith, the brilliant but cheerily indolent young mathematician who had been employed in the observatory computing section. Strangely, he is exempted from the suffocating care of the humanoids. Claypool fails to understand his freedom, and suspects him of some treacherous deal with the machines.

Fighting the humanoids, Claypool finally reached the hidden vault of Project Thunderbolt, resolved to smash Wing IV. He found the installation sabotaged. The missiles were gone, and he suspects that Ironsmith was the smiling saboteur.

With a broken leg and an injured knee, Claypool was captured by the

humanoids, and drugged with euphoride until after the bone had knitted. Ironsmith had him awakened, and asked him to betray White—offering to let him join the same Compact which earned his own unfair freedom.

Refusing to turn against mankind, Claypool was rescued by White. Sealed in a deep cave, with White's little band, he studied psychophysics and helped build the new relays, which were to modify the Prime Directive and set men free. When the new relays were finished, he was teleported to the Central, on Wing IV, to install them.

Before he and Dawn Hall can finish the installation, however, Frank Ironsmith appears to stop them. Claypool fights vainly, and hurts his knee again. He then calls on the child to kill Ironsmith—for White has taught her a mental trick of detonating the unstable potassium isotope, and Claypool begs her to disrupt the K-40 in Ironsmith's blood.

But Dawn seems strangely frozen. Her face drains white and her eyes dilate into staring blindness. She smiles out of remote oblivion, and speaks to Claypool with the whining drone of another humanoid. She has been—mechanized!

Stunned and beaten, Claypool follows Ironsmith out of the Central.

Part 3

XXIII.

Beyond that narrow door, they came back into the dusty clutter of the shop where old Sledge had built the first mechanical unit and the first sections of the relay grid to run it—the first germ cell, of metal and silicone plastics, from which all this ultimate and monstrous machine had grown.

Claypool clutched anxiously for the jamb of the door, and limped gratefully off that giddy walk. He sank wearily into the rusty swivel chair, at the desk old Sledge had used, and tenderly eased his throbbing knee.

Behind him came Dawn Hall.

The smiling child walked that unrailed path out of the dusky cavern of the Central, with the quick gliding grace of another humanoid. She halted at the end of old Sledge's battered desk, motionless as any stopped machine.

She kept on smiling. Her pinched face was set, lifeless, bloodless. The pupils of her eyes were dilated, relaxed into great pools of shadow. She seemed blind as any humanoid. And she smiled without mirth or joy, out of some frozen, far oblivion.

Claypool looked away from her. He mopped his face and tried to swallow the dry horror in his throat and blinked bitterly at Ironsmith.

"How—?" he croaked huskily. "How am I to blame?"

Ironsmith strolled absently about that gray-lit, stale-smelling room. He glanced at the faded backs of old Sledge's reference books, idly spun the loose headstock of a bench lathe, curiously tapped the time-stiffened keys of a tiny portable calculating machine—a remote forbear, that

may have been of the Central itself.

Dust came up in little gray puffs about his shoes, and dust left white marks on his dark suit, where he had brushed the benches and the drafting table. Deliberately, he thrust both hands deep in his pockets, and turned back to Claypool with a slow frown of thought.

"The humanoids have to guard the Prime Directive."

His voice was calm and soft and friendly as if Claypool had never urged the child to detonate the unstable potassium atoms in his blood.

"Sledge built that into the Central. When such blundering fools as you and White attempt to attack the Prime Directive by paraphysical means, the humanoids are compelled to develop paraphysical instruments of their own, to defend it. As you should have learned by now, they are thorough and efficient. Their efforts have been effective."

Claypool kept his eyes off the frozen child.

"Theirs?" he rasped savagely. "Or yours?"

Ironsmith stood silently, merely watching Claypool with gray troubled eyes. And a sudden gust of wrath brought Claypool out of the rusty old chair. His knee tried to buckle again, and he caught the corner of the old desk.

"So you don't deny it?" He spat on the dusty floor. "I guessed the truth a long time ago—when you seemed to like those vicious machines so well, and they always left you free. You . . . you traitor!"

He gasped for breath, and shook his skinny fist.

"Well, I don't suppose you can deny your ugly treason now. Not when you're right here on Wing IV—murdering the last chance for freedom the rest of us will ever have! Not when I know about this wicked Compact—whatever it is—between you and these machines."

Ironsmith nodded his bare head, calmly.

"It's true that a mutual pact exists," he admitted pleasantly. "Because the humanoids aren't creative, but merely logical. They couldn't have protected the Prime Directive from paraphysical attacks, without human assistance. The Compact provides that aid."

Bleak-faced with hate, Claypool clung weakly to the splintered edge of the old desk, and Ironsmith stood frowning in doubt. The younger man rubbed the lean angle of his sunburned jaw, and strolled about the dusty shop again, and nodded at last in calm decision.

"We're going to give you one more chance to join us, Claypool, in the Compact."

Claypool peered hard at that honest and friendly-seeming man who had turned against his kind. He shook his head, perplexed.

"Thank you," he muttered, sardonically.

"Not me." Ironsmith smiled pleasantly. "There is someone else who is still willing to forgive most of your follies, and risk much to help you. Your thanks should go to Ruth—who was your wife."

"Ruth?" Claypool peered at him, narrow-eyed. "Ruth's at Starmont, under euphoride, with her mind and memory gone."

"She was," Ironsmith smiled again, open-faced and innocent. "But I had always admired her—more, I think, than you ever did. I brought her away with me, when I left Starmont. She has her memory now, and she's with us in the Compact. She'll be happy if you join us."

Ironsmith paused, hopefully.

"What shall I tell her, Claypool?"

Claypool's bad knee shuddered, and he gripped the old desk to support his weight. His stomach became a writhing knot of pain, and for a moment he couldn't breathe or speak.

"So she's with you?"

He nodded bitterly. He had never entirely liked Ironsmith—not even long ago, before the humanoids came. Now, in a shocking flash of intuition, he thought he saw the reason. Now, at last, he thought he understood the cause of Ruth's unhappiness, that the humanoids had tried to cure with euphoride.

The desert observatory had been an intimate little world, and Project Thunderbolt had left him too little time for Ruth. And young Ironsmith, he remembered bleakly, had always been very conveniently about, at the office and the cafeteria, at staff parties and on the tennis courts. Indolently brilliant, tossing off his work without apparent effort, he had been too handsome and too gay and too free.

Claypool clung to the ancient desk. His stomach burned. His skin felt feverishly hot, and then pimpled to a clammy chill. He heard a roaring in his brain. His whole body tensed and shook with hatred, but his throbbing knee was useless and he knew he couldn't fight.

He knew it was far too late to fight. It must have been too late, ever since the supernova flamed. He caught his rasping breath, and deliberately turned his eyes away from the smooth treachery of Ironsmith's clean, sunburned face. He tried to control the fury raging in him. And he saw the child again.

She stood very tiny and very straight, and still as a stopped machine. Dilated eyes stared blindly from her stiff white face, and nothing fluttered the ribbon in her hair. Shivering with pity and terror, Claypool swung abruptly back to Ironsmith.

"I'll go with you," he said flatly, "on one condition."

Ironsmith turned suddenly genial.

"Then you're willing to enter the Compact?" he asked softly. "To join our group, and accept the humanoids, and help defend the Prime Directive from any change." He offered a vigorous, sunburned hand. "Welcome, Claypool!"

"On one condition," Claypool rapped. "Dawn comes with me."

"I'm sorry, but that is out of the question." Ironsmith seemed regretful, and apologetic. "We can still rescue you, Claypool. But the child used paraphysical powers against the Central, in this unfor-

tunate attack, and there's nothing we can do for her."

A bleak hostility shook Claypool's voice again.

"Then there's nothing you can do for me."

"I'm sorry for you, and Ruth will be hurt." Ironsmith shrugged his lean shoulders, and Claypool hated him again, for his arrogant security in all the spoils of his duplicity. "But I imagine the humanoids will need another guinea pig, to test their new relays."

He looked at Dawn, and she spoke.

"At your service, Mr. Ironsmith." Her voice was a thin, high whine. "Since Dr. Claypool refuses to enter the Compact, we must keep him in our care. His extensive knowledge of rhodomagnetics makes him dangerous to the Prime Directive."

Beyond her, the other door had opened. Two identical mechanicals came gliding through. Their dark bodies were beautiful with flowing gleams of bronze and blue, and their graceful faces were serenely kind. They came to Claypool, and Dawn spoke to him.

"At your service, sir. You must come with us."

Smoothly as any humanoid, she moved toward that outer door. Claypool followed her, limping uneasily between the two blind intent machines.

He looked back twice. The first time, Ironsmith was still there beside the old dusty desk, tall and young and stern, watching him with a dispassionate regret. When he looked again, that gray-lit room was hushed and empty. Ironsmith must have learned to govern the exchange forces, too.

His scalp tingled and his breath went out, but his black keepers seized his elbows and hurried him after the child. Outside, a little rhodomagnetic cruiser was waiting for them. It hovered silently, just above the railing of that high balcony. The smooth oval hull of it mirrored the gray vastness of the tower and the smoky murk of the sky and the dark flatness of Wing IV, all in shimmering distortion.

The door of the craft was open. Dawn sprang up to the deck, as agile as any machine. Watchfully, the two machines assisted Claypool. The little ship rose silently. Standing between his guardian machines, Claypool looked out through the one-way transparency of the hull.

Wing IV spread out beneath him as they lifted, veiled with thin smoke and teeming with machines. Once this world had been alive—until war wrecked it, and old Sledge's humanoids reclaimed it.

It was all leveled now. Mountain and sea were gone, and everything alive. There were only landing ramps and cradles for tall black interstellar ships, and busy ways where no man moved, and the round black mouths of the pits that let shipping down into the planet's mechanized heart.

The cruiser dropped again, and Claypool saw their destination. It made his stomach contract, and his

bad knee shudder. The two intent machines moved closer to his arms, asking softly if he wished to sit.

He didn't sit. He stood between them, stiff and cold, and watched that unfinished dome come up ahead. The huge curve of it was strangely graceful, taller than its width. Luminous, it splashed that dark, smoky plain with a red violence.

He could see the scaffolding still about it, a dark metal veil about its sullen glow. The craft dropped nearer, and at last he found the toiling machines on the vast platforms, the merest dark insects, scarcely visible. It looked almost complete, and his heart turned sick.

"At your service, sir," droned one of his dark guardians. "What disturbs you now?"

"I just begin to get it," he whispered bitterly. "I begin to see what this monstrous thing is for!"

The craft swayed and tilted, dropping to land, and his bad knee gave again. One of the tiny machines reached quickly to support him. He cuffed at it savagely, but it ignored his feeble blow, and held him until the deck was still again.

They came gently down on a wide stage, beside a long, windowless building. The red dome loomed beyond it, fretted with black scaffolding, immense as a strange moon rising. Claypool shrank back from it, shaken and afraid.

"Now I begin to see your ugly schemes," he rasped at the helpful, calm machine. "I think those platinum relays are paraphysical. I think Ironsmith and his gang of renegades have taught you how to generate paraphysical energy, and told you how to build this new grid."

Something turned his voice to a dry whisper.

"And I think it's intended to operate men."

"That is true, sir." His brooding eyes had moved to Dawn Hall, and now she broke out of that stark immobility, with a smooth mechanical grace which startled him. Sweetly melodious, her high, whining voice reflected nothing human.

"This new relay grid will be energized with paraphysical force, when it is done. It will be able to control the minds and bodies of men, anywhere, whenever necessary to fulfill the purpose of the Prime Directive. But it is not wicked, sir, as you imply, or evil in any way."

Her thin strange voice was bright with a merciless kindness.

"Because our only function is to secure the greatest measure of happiness for all men, under the Prime Directive. In the past, we have sometimes failed. A few unfortunate individuals, developing paraphysical abilities, have eluded our care and endangered our whole service. But this new grid, when it is done, can rule every thought and every act of every man. We shall use it to cause all men, everywhere, to do only what is good."

Claypool stood numbed and voiceless.

"Men have need of such control," droned the wax-white child, "because most men cannot truly control the working of their own bodies, or understand the functions of their own minds. We seek only to pro-

tect men from their own ignorance and folly and vice. Surely that purpose is not evil, sir."

The door of the little craft slid open.

"Now come," the child said. "Here is our paraphysical laboratory."

XXIV.

Carefully, the two black machines helped Claypool down from the deck. Shivering in the red shadow of that enormous, glowing dome, he limped laboriously across the landing stage, following the mechanized child.

As he watched her, his fevered mind could see a dreadful vision, of whole worlds possessed. He saw whole peoples, moving like living puppets on the invisible strings of the perfect master machine. He glimpsed the ultimate despotism, under the Prime Directive, utterly benevolent and unthinkable.

That was to be the fruit of the monstrous Compact, between faithless men and ruthless machines, which Ironsmith had asked him to join. Claypool drew his narrow shoulders furiously straight, and spat on the landing stage, and limped bitterly after the child.

In the gray, windowless wall ahead, a narrow doorway opened. Beyond was a vast, gloomy space. He glimpsed the dark loom and the metal gleam of strange machines, and a sharper apprehension checked his feet. He didn't want to be a guinea pig.

His two intent keepers saw his hesitation.

"You need not be alarmed for yourself, sir," came a cheery purr. "Or concerned about the child. Because our paraphysical research is very efficiently conducted. We are careful to cause no pain, or any needless bodily harm. The individual awareness is always completely suspended, in persons under paraphysical control."

Still Claypool didn't move. He didn't want his mind dissected, not even by the latest and most efficient methods. But the two guardian machines moved in swiftly, to grasp his shrinking arms. They thrust him forward, calmly and gently, into the laboratory.

It was a whispering cavern of shadowy terror, for the blind machines had no need of light. The only illumination came through the bars of an endless row of metal cages built along the foot of one high wall—cages very much like those Claypool had seen containing experimental animals, for biological research.

In that enormous space, those cages seemed quite small at first. The dim light from them spread across the endless floor, and diffused upward toward the unseen ceiling. Here and there it outlined the dark bulk of some immense unknown mechanism; it picked out some polished metal surface; or it glistened briefly on the sleekness of some tiny, hastening humanoid.

His bad knee began to tremble painfully, and he tried to stop again. The two tiny machines lifted him deftly, and carried him on with an effortless strength. Ahead of them,

the barred door of one empty cage slid upward, actuated by a hidden relay. They set him down inside.

One of them stayed with him.

"You must wait here," it droned softly. "We shall be ready soon for the tests of the new grid in which you are to be used. In the meantime, we are at your service. You may ask for anything you wish."

Behind him, the door locked itself again, with a muffled, disconcerting click. His black guardian stood abruptly motionless. The dim gray glow of the radiant-painted walls glistened faintly in its naked sleekness, and gleamed on its bright steel eyes.

Claypool muttered his sardonic thanks, and looked about the cage. He found a narrow cot, a chair, a small table. Through a narrow door behind, he saw a white, tiny bath. The gray-glowing partitions shut off the other cages, but he could see out into the dark beyond the bars.

He limped wearily to the cot, and sat down on the edge of it. The air seemed cold, and it was bitter with a penetrating antiseptic smell. The gray walls suddenly squeezed in upon him, and the thick dark beyond became a crushing pressure. He couldn't breathe, and his sore stomach writhed, and he was sick with claustrophobia.

His black keeper came quickly to him.

"You have no reason for alarm, sir," its golden monotone assured him benignly. "For you will feel no pain at all. In fact, as a very distinguished physicist, you should desire to aid our paraphysical research."

He stared up bleakly, at its dark blind face.

"We follow the scientific methods which other men have taught us, under the Compact," it went on brightly. "The basis of all our work is a simple assumption. If paraphysical forces cause mechanical effects, then mechanical means can generate paraphysical forces."

He tried to listen. Sitting cold and ill on that hard narrow cot, he tried to breathe the bitter air. He tried to push back the cold gray glow of the closing walls, and tried to endure the smothering oppression of the dark. He rubbed his swollen knee, and tried to understand.

"We have proved that assumption," purred the machine. "With the aid of a few loyal men, we have designed instruments for the detection and analysis of the paraphysical forces. Other disloyal men, foolishly attacking the Prime Directive, have provided experimental subjects."

Shivering on the cot, Claypool wondered what had happened to little Dawn Hall. He had lost her in the dark, and he couldn't see the other cages. He couldn't find her now.

"As another scientist, sir, you can follow our research methods. Our subjects, under strict experimental controls, are caused to exert paraphysical forces. We measure those forces, investigate their origins and determine their effects, and duplicate them by mechanical means."

Claypool watched the blind face before him, and fought his smother- his mind held on to a last desperate hope.

"Unfortunately, we are not creative," that silvery voice sang on. "But loyal scientists have derived new hypotheses from our accumulated data, and suggested new experiments to test them. And now we are near our final goal."

Claypool had slumped abjectly back against the cold metal partition. With both clammy hands, he nursed his throbbing knee. And his mind held on to a last desperate hope.

"The final result of our research will be the completed paraphysical grid. Any human body under its direction will be operated far more efficiently than is possible by the slow and feeble natural brain. It can control the body to prevent clumsy accidents, and eliminate all disease, and mend the decay of time. It can heal mental illness. It can even stimulate the body to repair deformities, and replace missing members. It can make every human being young and fair, forever."

Claypool shrank back from gleaming steel orbs of the machine. His narrow shoulders pressed hard against the cold wall behind him, shuddering. And he clutched desperately at his last thin thread of hope.

"So you see that our methods are sound and our goal is good, sir," his tiny keeper finished serenely. "You see that you have nothing at all to fear. As a scientist, your love of truth and your sense of duty toward your kind should make you glad to offer your own small contribution, toward this greatest possible humanitarian undertaking."

That golden melody abruptly ceased. In absolute efficiency, the humanoid ceased all movement. Claypool sat before it on the cot, nursing his knee and his feeble hope.

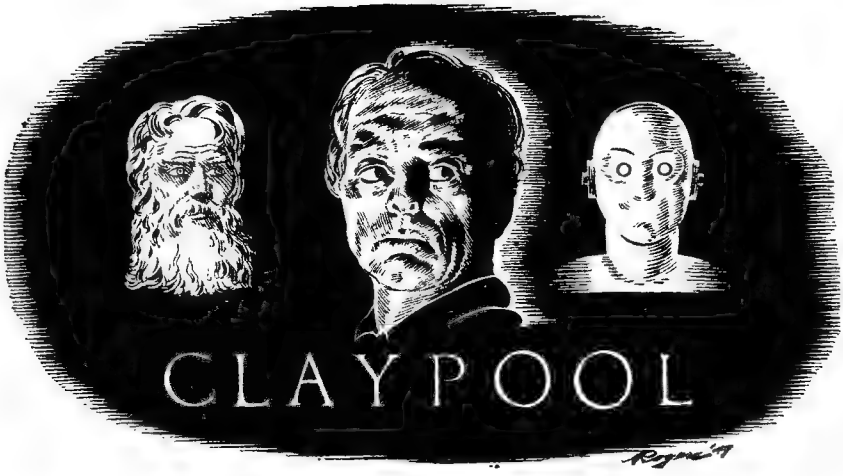
Desperately, he clung to the memory of a sealed and secret limestone cavern, that no humanoid could enter. White, he thought, must still be safe there, yet unvanquished. His three adepts, Graystone and Overstreet and Ford, must still be with him, toiling desperately to turn their freakish paraphysical powers into a new science of the mind. Perhaps, Claypool dared to hope, White might survive this last defeat, and somehow find a better weapon.

"At your service, sir," his tiny keeper droned again. "You should let yourself relax, and make the best of this brief delay. If you are hungry, you may have your tray at once. If you wish to sleep—"

That was all that Claypool heard, for he saw a huge, red-bearded figure striding out of the dark beyond the cages. He sat breathtaken for a moment, unbelieving. But he knew the beard, and the worn silver cloak, and the massive, shaggy head.

The striding giant was White.

The feeble strand of Claypool's hopeless hope became a mighty



thing. He lurched to his feet, and his knee was strong again. He darted past his frozen keeper, and tried to shake the massive gray bars in the door of his cage.

"White!" he shouted. "Here I am—"

But that tall stalking figure ignored his urgent voice. It went on by. It didn't even turn its great, fiery head. He had the merest glimpse of its face, strangely stiff and pale. And it marched on by.

All his hope went with it.

His knee shuddered under him, and he clutched the gray bars with weak and stricken hands. For he had seen the eyes of that stalking thing, and the blue sullen blaze of White's old hate was dead in them now. They were distended, huge and dark and blank, sightless as the metal orbs of the machines.

He had seen its face. Still and white behind the splendid beard, it was smiling out of some far place of cold forgetfulness. That unchanging smile somehow reflected the serene benevolence of the humanoids. It was beyond hope or hatred, free of all feeling.

And the movements of that stalking thing, he realized dully, had nothing characteristic of White. Its striding gait had been too quick and sure. Its feet had fallen too lightly, without sound. Like Dawn Hall, it was now a mechanical puppet of the grid.

And it was not alone.

Clinging to the bars, Claypool saw the others. They came marching toward the cages, out of the whispering dark. Still tall and gaunt, old Graystone was no longer awkward now, and the red of his nose had faded to a putty-gray. Overstreet, for all his puffy bulk, moved lightly as a child. No longer nervous now, little Lucky Ford came gliding with a serene mechanical felicity.

Claypool found no voice to call again, and none of them seemed

aware of him. All their eyes had blind, distended pupils, and all their faces smiled coldly out of some remote oblivion. They all walked too quickly, too lightly, too silently.

A parade of automatons, they passed on by.

Claypool gripped the bars and stared into the busy, murmuring dark. But his eyes saw nothing except the monstrous shape of final defeat, and he started when his keeper touched his arm.

"At your service, sir," it whined solicitously. "You will only tire your injured leg, with standing too long. You should bathe now, and let us massage your knee. And then you should sleep."

He turned and limped obediently toward the tiny bath behind the cage. He let his keeper take his arm and help support his weight. For he was beaten. There was nothing left to do. He nodded at the way those smiling automatons had gone, and whispered listlessly:

"How did you capture them?"

"We found them when we took the mind of the child. They were hiding in a cave that had no physical entrance, but that did not protect them. Paraphysical impulses from the energized test section of the new grid reached into it, and took hold of them."

Claypool had paused, dazed and ill.

"Come along and let us bathe you," urged the small machine. "Now we can only massage your knee. As soon as additional sections of the grid can be energized, however, we shall try them to heal the damaged ligaments."

Claypool limped along with it, passively. He let it put him to bed, and tried to forget the bars that shut him in. Lying in the narrow cot, he closed his eyes to shut out its blind benevolence, and tried to solve a riddle.

He had no purpose left, but still he was a scientist. He had learned the habit of fitting facts together, to form new patterns of the truth. Now, when he lay there alone and hopeless, his sick mind turned back to find relief in that old pursuit.

He attacked a riddle old as science—the atom. Electromagnetics has never quite blueprinted atomic architecture—because the straining electrostatic forces, the mutual repulsions of the like particles captive in the nucleus, were all disruptive. Electromagnetic atoms simply couldn't exist.

He had tried this same riddle many times before. Once, years ago at Starmont, he thought he had found the whole answer to it—in the basic equation of the rhodomagnetic field—until young Ironsmith so casually and cheerily proved him wrong.

The dimensions of the time-quantum were implicit in that equation, and those dimensions placed a limit on electrostatic forces, because their velocity of propagation was finite in time. Electrostatic forces must, therefore, cease, at subnuclear distances. The remaining known component, of timeless rhodomagnetic forces, served to explain the

stability of the lighter atoms—almost.

But not quite. The staggering answers that Ironsmith brought from the computing section convinced him there must be an unsuspected third component, which must become increasingly important in the heavy atoms toward the end of the periodic table. The cruel demands of Project Thunderbolt had left him no time to follow that astonishing clue. But that component, it came to him now, must be linked to the heavy metals of the platinum triad.

And it must be paraphysical energy!

That flashing intuition was a white illumination, which lit many things. He lay on that narrow cot with his eyes closed against his blind keeper, and tried to slow his breathing back to normal. He forgot the bars, and his aching knee, and began exploring the universe by that tremendous, sudden light.

Absently, he wished for Ironsmith's computing section, to check his answers for him. But he hadn't even a slide rule, or a scratch pad to jot his new equations on. He had nothing at all, and he didn't even dare to move.

He lay still, and roved through atoms and suns.

It wasn't hope which urged him—not consciously—for he thought that hope was dead. He had yielded himself to the humanoids, and relaxed all resistance. He just lay there, and let his brain seek relief in the familiar ways of science.

And he found the answer to that ancient riddle.

It was a simple equation, which related electromagnetic and rhodomagnetic and paraphysical forces, to explain the structure and stability of the atom. It all seemed obvious, and he wondered why it hadn't come to him before.

The sheer mathematical beauty of it brought him a glow of pleasure. For it was basic. The keystone, he thought, that supported all the ordered splendor of the universe. The transformations of that equation, he knew, would explain the origins of atoms and the universe, the attraction of suns and the dispersion of galaxies, the dark paradox of time and the birth of life, and even the evolution and function of mind.

He lay quite relaxed on the hard cot, lost in the elemental grandeur of the concept. He had forgotten the gray-walled cage around him, and the sleepless keeper watching him, and the unpleasant fact that he would soon become an experimental specimen—until the black machine softly touched his arm.

"At your service, sir," it purred. "We're ready now—"

And then he was no longer in the cage.

XXV.

He wasn't even on Wing IV.

He stood on a flat gravel bed, at the bottom of a shallow dry watercourse. On his left were low cliffs, apparently formed by an outcropping ridge of dark ancient granite, against which the stream had sometime cut. Far away, on his right,

long-eroded hills lifted low and bare and dead beyond the wide black valley of the vanished river.

It was night, and cruelly cold.

The sky above the low black cliffs and the far black hills was utterly cloudless, and yet strangely dark. The most of it was a dead and utter black, scattered with a few tiny oval blobs of misty light. Before him, however, that dark valley was arched with a high tilted curve of pale white splendor. It was a tall, leaning dome of luminous white mist, bright with diamond atoms.

That cruel cold took his breath and seared his skin—for he stood barefoot on the hard, frozen gravel, clad only in the thin gray pajamas he had worn to bed. For a moment he stood shivering, utterly bewildered. Then he felt a child's small hand, tugging anxiously at his fingers.

"Oh, Dr. Claypool!"

He looked down and found Dawn Hall beside him on the river-worn gravel. She was no longer a creature of the grid. For her huge dark eyes could see again, and that cold smile of far oblivion was gone. She was shivering and afraid.

"It's so awful cold!" she said. "Oh, please—what can we do?"

"I don't know," he told her blankly. "I don't even know where we are."

He found that he couldn't speak, because that dreadful empty cold had taken all his breath. His throat was dry and his lungs were burning and his lips too stiff to move. He made no sound—and heard none, for this dark world was utterly dead. Yet somehow she understood.

"But I know," she told him—and then he realized that he hadn't heard her actual voice at all. "'Cause this is where Mr. White used to send me to pick up nuggets for him. I used to hurry back with them to the cave, before I got too awful cold. But now we can't go there again, 'cause the black things would catch us."

Her tight fingers were icy on his own.

"Oh, where can we go?"

Claypool swayed to a stunned understanding. He remembered those nuggets of alluvial palladium, that Dawn had brought to White from some far-off, airless, sunless planet, cold to the absolute zero. He stared around him again, numbed with wonderment.

Now he understood the starless blackness of the unclouded sky, and the merciless still cold, and the diamond-dusted splendor of that tilted arch across the black and barren valley. For they were lost, somehow, on this wandering world beyond the Galaxy.

Those tiny oval blots against the dead and empty dark were other island universes, remote beyond knowledge. And that leaning dome of luminous mist was the edge of their own Galaxy, seen with light which must have left its dust of suns a long thousand centuries before the first man ever dreamed of voyaging away from the mother planet into the silent seas of space.

"It's so awful cold," the frightened child was sobbing again. "I

can help us for a little while, but then what can we do?"

Blankly, Claypool shook his head.

It must have taken a billion years, he thought, for this lost atom to drift so far through the extra-galactic dark. It must have been time beyond imagining since some vanished sun had warmed these old black hills, and vanished waters had washed this frozen gravel.

This world was dead, and no day would ever break the black, silvered splendor of this cruel, soundless night. Nothing could live here long. He remembered the crackling frost which caked Dawn's nuggets in the air of the cavern. Nothing could live at the absolute zero.

His hands were empty and his weak knee throbbed and the rough gravel burned the soles of his feet. He peered around him hopelessly, at the low frowning cliffs and the bare, forbidding hills. He knew they would find no aid or comfort here.

"I don't even know how we got here," he told the child. "I don't know anything to do."

She stood straight and tiny in that old leather coat, too large for her, with the bit of scarlet ribbon stiffly frozen in her black hair. Her dark eyes looked at him, full of solemn trust and pleading.

"Can I help you?" he begged. "Can you tell me how to help you?"

But she only shook her head, shivering and afraid.

She was keeping them both alive, he knew. White had speculated on the unconscious arts which enabled her to live—a little while—in this airless cold. She had adapted to it, somehow, paraphysically. But there was nothing she could tell him, and no help that he could give.

He felt the silent fangs of cold, stabbing through his flesh. His throat burned, and his empty lungs. But he could still feel Dawn's stiff tiny fingers, clutching desperately at his hand. His blurring eyes could see her shifting uncomfortably back and forth, to lift one bare foot and then the other away from the searing gravel.

And he forgot himself.

He bent to pick her up, and his bad leg buckled. He knelt on the gravel, and lifted her. He held her against him, and tried to shield her with his arms. He thought there was nothing else that he could do.

He could feel her desperate tension, but he knew no way to share her burden. Abruptly she swayed against him, shuddering, and then he felt the cold grasp at them again, with a new and implacable fury. Her strength was ebbing, and he felt an infinite compassion.

Then she stirred feebly in his stiff arms.

"The door!" She tried to point. "There—"

Turning painfully where he knelt, he saw a faint gleaming something above the ragged rim of the low black cliffs. He blinked his dimming eyes, and made out the smooth curve of a transparent cupola there, washed with the pale radiance of the far Galaxy.

Below that tiny dome, he saw a

green light burning. He shook his head stiffly, and stared again. It was a light! Glistening on polished metal surfaces, it shone through a round metal doorway in the black hostile face of the ancient cliffs.

He merely gaped at it, mistrusting his own failing senses. For his eyes were smarting and bleared, and a painful roaring was increasing in his ears, and a frosty numbness grasped him. For a long billion years, he thought, nothing could have lived to make a light on this dark world. And he knew the cupola and the doorway hadn't been there, when he first saw the water-worn cliffs.

"Please!" Dawn sobbed faintly. "Please hurry—"

He didn't wait to wonder any longer. He swayed laboriously to his feet, and picked her up again. His feet no longer hurt, and even the pain in his knee was numbed, but his limbs seemed stiff and dead. He toiled across the hard black gravel, toward that green-lit opening. Three times he fell, and kept the child in his arms, and came up again. Slow and stiff and clumsy, like a machine running down, he went on again. And he came to the shining metal threshold.

Stumbling into that narrow metal chamber, he saw that it must be an air lock. His painful, blurring eyes found a row of buttons. One glowed dimly green. He punched at it stiffly, with a finger that had no feeling left, and a massive valve slid shut behind them.

Air screamed in about them, a warm and kindly hurricane. He filled his burning lungs again, and breathed. His dry, stinging eyes began to clear, and that roaring died out of his ears, and his stiffened feet began to feel the good warmth of the floor.

Still he held Dawn in his arms. She was very cold, very limp and still. He caught her small blue wrist, and found no pulse that he could feel. But then she shuddered convulsively, and drew a long sighing breath. Her dark eyes open, seeing again, full of a warm devotion.

"Oh, thank you, Dr. Claypool!"

Her clear treble voice was her own again, and now he could hear the grave sweetness of it. The smile on her thin face was human, now, relaxed and happy.

"I think Mr. White would say you're very, very good!"

He set her down on the warm floor beside him, and looked about him with a heightened bewilderment. Any shelter for them, on this long-dead wanderer of the dark, had seemed unbelievably improbable, and now he began to notice singular things about this strangely convenient haven.

Certainly it wasn't a billion years old.

The warm air had a faint, familiar smell of new paint. The buttons which worked the valves were made of the latest translucent synthetic—and neatly marked with words that he could read. Riveted to the control case of the automatic mechanism was the familiar name plate of the Acme Engineering Corporation—a small firm which had supplied

certain machinings for the neutrino search tubes of Project Lookout.

Experimentally, he pushed a button marked INNER VALVE—TO OPEN. Something hummed obediently, inside the case. An amber light flashed, and a warning gong whirred. Then another heavy wedge of polished steel slid down, and let them into the shelter.

Voiceless with a baffled astonishment, Claypool took the breathless child by the hand, and they went on to explore this curious haven. A tunnel led them back into the rock. It was lined with plates of smoothly welded metal, painted with the same shades of cream and gray that Claypool had chosen for his own office, at Starmont. The soft illumination came from fluorescent fixtures—which bore the familiar trade-mark of United Electric.

Doors were spaced along the tunnel, all fitted with knobs that he could turn instead of concealed relays. Claypool peered into the rooms behind them, shaken with a mounting bewilderment.

The first room housed a power plant. A small rotary convertor hummed silently beside a bank of transformers, and a stand-by waited silently. He looked for the generator, and caught his breath. For all the current seemed to come from one small cell, with a name plate which read: Starmont Rhodomagnetic Research Foundation.

That was impossible. Claypool blinked at it, and shook his head. Once he had dreamed of establishing a nonprofit foundation, to develop the wonders of rhodomagnetics for the benefit of man. But the harsh demands of military security had nipped his hopes, and the destructive science of Project Thunderbolt had taken all his time.

Another room was a kitchen—oddly like Ruth's, in their house at Starmont. The electric range and the refrigerator were the same white, shiny United Electric models. The cans and cartons of food on the shelves were all bright with the labels of standard brands.

He found a room for himself, and one for Dawn. The little table beside his bed was stacked with a dozen of his favorite books—but none that he hadn't read. His bathroom was thoughtfully supplied with his favorite brands of soap and toothpaste.

At the end of the tunnel, a narrow stair led upward. They climbed it, and came up into the crystal-domed cupola above the ancient granite outcrop. Claypool stared out through the curving panels, chilled with an awed perplexity.

Outside the warm comfort of the shelter, that frozen landscape lay unchanged. The cruel sky was black and strange above. The high curve of the Galaxy stood like a leaning plume of luminous dust beyond that barren, empty valley where sometime water must have run; and the pale frosty light of it fell faint and cold on the black cliffs, and the black eroded hills beyond.

Leaning on a little table at the center of the floor, to ease his weary knee, Claypool stood a long

time staring at that tall splendid arch of silver-and-diamond dust. The cold and the loneliness of this starless world took hold of him again, and he shuddered a little. Dawn caught his hand, whispering anxiously:

"Is it something very bad?"

He didn't want to frighten her, and he smiled down at her thin, apprehensive face with the best assurance he could find.

"Nothing bad," he said. "I just don't understand it. I don't quite know how we got here—so far from home that all the stars we ever saw are lost in that cloud, yonder." He peered at her solemn face. "Did you bring us, Dawn?"

She shook her head.

"And I don't understand this place in the rock. At first it wasn't here, and then it was. Everything looks as if it had been built by men—from our own world. But I don't think any men ever lived here."

She gaped at him, as if amazed.

"I just don't get it," he said. "Everything is so—familiar. The books I like to read, and the kind of toothpaste I use, and even a bottle of the capsules I used to take for indigestion. The bottle has my doctor's name on it, and even the right prescription number!"

Dawn frowned at him, perplexed as he was.

"Don't you 'member?" she whispered softly. "Don't you know?"

He blinked at her, abruptly voiceless.

"It's kind of funny you don't 'member," she said gravely, " 'cause you did it all. You found me, and took me away from that awful place, where the black things have Mr. White and poor Mr. Graystone and poor Mr. Overstreet and poor little Mr. Lucky. All I did was show you where to come—far away from all the black things."

He merely stared at her, stunned.

"And then you made all this place, after we came," she said. "You made it all, while we waited out there in the cold." She nodded toward the dark alley. "It's a pity you don't 'member, 'cause you could be awful good at paraphysics."

XXVI.

Claypool looked down at his hands, and flexed them unbelievingly. They were small wiry hands, sensitive and competent, and they had been useful to him once. Since he had seen the beautiful, tapered black hands of the humanoids, however, they seemed clumsy and weak and slow. Now his fingers still ached a little from the cold, and his knuckles were still dark-scabbed where he had peeled them, awkwardly trying to install the new grid sections. He stared at his hands, and his knobby fists clenched uselessly.

Dawn semed to read his perplexity and doubt.

"You didn't use your hands, at all," she told him solemnly, " 'cause you were out there, waiting with me in the cold. You did it with your mind. Don't you 'member now?"

But Claypool didn't remember.

Dazedly, he peered around the

little cupola. The little table, lit from a shaded fixture, was like one he had used at Starmont. Neatly arranged on it were scratch pads and sharpened pencils, a slide rule, and several technical handbooks—one of them, listing tables of rhodomagnetic constants and coefficients, was by W. Claypool.

The back of his neck prickled uncomfortably.

"That's my name," he whispered. "Those are values I had worked out. But that book was never printed. The censorship. I don't see how—"

His voice fell away into a chasm of wonder, as dark as the dead night above.

"You did it with your mind," Dawn insisted softly. "You did it with paraphysics, like Mr. White taught me how to change potassium atoms and stop the black things. Only I think you can change any atom, and let it go into energy, and then make the energy right back into any other atom. I think you know more about paraphysics than even Mr. White—if only you could 'member."

Claypool stood speechless, unbelieving.

" 'Cause I saw you," she said. "I watched you cut out this place, and make the rock into other things, and build it all up ready for us. I saw this window-thing come up, and the door open, and the green light shine—all because you made it. An' I'm glad you did, 'cause I was getting cold!"

Claypool stood peering at a thermostat in front of the ventilator register beside the stair. It was a good copy of one in the unused nursery of the house he and Ruth had built at Starmont, so long ago. His narrow shoulders shrugged uneasily.

"I can see I must have made it," he admitted, "because everything is somehow copied from something in my own mind—from machines I've seen, or books and articles I've read, or ideas I had thought of. But I don't see how—"

He shook his head, in stubborn doubt.

"But there simply wasn't time!" he insisted. "The whole place just came here—instantly!"

"I'm afraid you just don't 'member." Dawn sighed, baffled. " 'Cause it seemed a long time to me, waiting out there in the cold, watching the rock while you changed it."

Claypool looked out again, at that windless world that lay beyond the dome, black and cruel and dead. Something touched his spine with the chill of the thin silver light that fell from the far, tilted Galaxy.

He knew the science of transmutation. Inspecting operating atomic piles for the Defense Authority, he had witnessed awesome demonstrations, in which a tiny sample of sodium or aluminum or platinum was cautiously thrust through an opening in the shielding, and came out again as a mixture of deadly radioactives that had to be handled with long tongs and watched with mirrors, but containing traces of new-made magnesium or silicon or gold.

He had seen that. And he knew the mechanics of nuclear transformation, by which the hot inferno of energies and particles in the pile rebuilt the atomic bricks of proton and neutron and electron into different elements. That was old stuff. But this—this was something different.

Cold granite dissolving suddenly to some inexplicable reagent of the mind, and flowing into sheets of welded steel thickly backed with insulating fiber glass, into sealed drums of compressed oxygen and bright-labeled cans of sweet corn, into that remarkable rhodomagnetic power and the slide rule on this desk—matter molded by sheer thought!

Because every electron, as a wave, exists everywhere. The chemical and physical properties of matter, he knew, are only patterns of electron identity. A change of pattern, he saw, would mean a change of substance—and the patterns are functions of exchange-force probability.

Probability! Itself an unsolved riddle, that must be the answer. Dawn had proved, many times, that mind-energy could somehow govern probability. Even little Lucky Ford had demonstrated that fact, long ago, with a pair of dice.

Here was—must be—the truth!

For an instant Claypool felt reassured by that flicker of understanding. But the brief illumination of it faded, and left him in the dark. White's old questions came again to haunt him. What was the stuff of the mind, and by what mysterious grasp did it hold probability? What were the laws, and where the limits?

He shuddered a little, and absently picked up the new slide rule. He nodded in approval. The sections slid easily, and there were four special scales he remembered wanting for rhodomagnetic problems. He put it down, and turned back to the troubled child.

"I must have made it," he said. "But I can't remember."

"You must try," she insisted desperately. "Please—try awful hard. 'Cause the black things still have Mr. White and the rest. We must try awful hard to help them."

Claypool nodded, and his lean jaw set.

"We'll try." And he stood a long time, gazing out across that dead landscape, at the high, leaning arch of diamond frost and silver dust which was the Galaxy. His face furrowed with weary effort, but the escape from Wing IV and the building of the shelter remained a blot of darkness.

Dawn watched his frown, and chewed her tiny fingers.

"Maybe if you think just how you learned it, maybe?" she whispered helpfully. "Maybe if you can 'member what you were doing, just before you can't 'member?"

He started, as it came to him.

"Of course—the basic equation!"

Queer, how he hadn't thought of that at all. Lying there on his hard narrow cot in the cage, with the dark machine on guard, he had been elated with the infinite promise of

that equation. But, somehow, he hadn't thought of it since. That enigmatic blind spot had somehow blotted it out of his mind.

Breathless, he found a pad at the little desk and hastily set the symbols of it down—shivering a little at the wonder of it, and taut with an odd alarm that somehow it might slip away again, beyond that mysterious wall of oblivion. Hopefully watching his pencil, Dawn whispered:

"Do you 'member now?"

He shook his head, and bitter tears came in her eyes.

"But now I think I begin to understand," he said. "I think this equation is the key, if I just knew how to use it. Because it describes the interaction of electromagnetic and rhodomagnetic and paraphysical forces."

He started to explain the symbols, but she shook her head.

"I can't read," she said. "'cause I never went to school, really, 'cept to Mr. White. Some things I can do, like teleportation and holding back the cold." She nodded, unafraid, at the black savagery of the silent world without. "But I never understand when Mr. White tries to 'splain how I do it. I'm sorry I can't help you, 'cause we've just got to save them."

Claypool scowled at the paper in his hand. Here, he knew, was the ultimate key to all the universe. Here was a secret of infinite power, which he had somehow learned, and used triumphantly, and inexplicably forgotten. He sat down at the little desk, and set out to get it back.

"Better go and play," he urged the child. "Or rest."

But she stayed with him in that dim-lit dome.

"Poor Mr. White is in such bad trouble," she insisted anxiously. "And Mr. Lucky and the others—the black things make them go like machines, and we must help them get away. You must try awful hard!"

And Claypool tried.

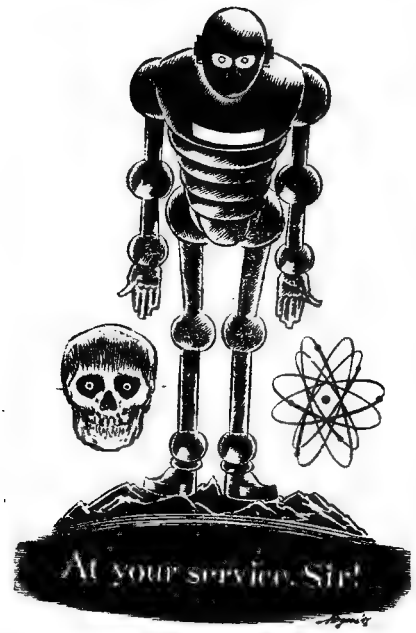
Standing silently against the railing above the narrow stairwell, Dawn watched him frown at the doodles on his papers, and sit scowling out into the still, windless dark, and scrawl more doodles, and then sit scowling again.

"These are the expansions and transformations of the prime equation," he told her once. "I'm trying to derive complete mathematical descriptions for all the paraphysical phenomena. Then maybe I can get it back—that art I must have used and forgotten."

She stood silent, confused by the long words and yet desperately hopeful. She saw him writing fast again, and then he looked out of the dome, at the bed of frozen gravel where she had picked up nuggets.

"Huh?" He made an odd little grunt, and suddenly his tired face smiled. "Now!"

Then she heard a tiny click, and saw the worn bit of white metal fall to the desk top before him. She recognized the rich white color of palladium. The nugget lay there a moment, far too cold to touch unless you knew how. It gathered a white mist around it, and it made a



tiny hiss and crackle, and it grew swift white feathers of frost.

And then it was gone.

The tired little man at the desk looked up through the paneled dome, at the cruel, empty sky. He picked up the slide rule and worked it quickly. Then his thin, hurried fingers made more doodles on the yellow pad.

Dawn had always felt a little sorry for him, because he wasn't big like Mr. White, and he had no fine red beard. He always seemed lonely and worried, and his thin shoulders had a troubled sag. She knew his leg was bad, and his face often looked as if his stomach hurt him.

But something changed him, now.

He stood up at the little desk, so quickly that the chair fell over behind him. He forgot his knee. His shoulders stiffened, and he seemed taller, and his soft brown eyes had a different look—a hard fighting brightness, like she used to see in the grim blue eyes of Mr. White.

"Cover your face!" His warning voice was different, too—low and quick and confident. "Don't look up!"

He glanced into the dark sky again, and made another pleased little grunt, and then put both hands over his own eyes. Dawn waited breathlessly, but nothing happened. A terrible fear struck her, that he must have failed again. She was looking at him anxiously, when it came.

It was brighter than lightning. It lit the cliffs, and the dry valley, and the flat hills beyond, with a sudden, savage light that turned them all from black to blinding white. Far off in the empty sky, she saw a new star. It burned brighter than the sun, and went out.

"Dawn!" He was breathless with concern. "Did I hurt you?"

She blinked her dazzled eyes.

"I stopped most of the light," she said. "Please—do you 'member now?"

The little man at the desk stood proud and straight. She thought he looked a little funny, with his bald brown head and his loose gray pajamas, but the furrows of worry were almost gone from his face. He smiled at her—a hard, eager little fighting smile, that reminded her of Mr. White.

"That was just one transforma-

tion of the basic equation." He pointed at his last scrap of paper on the desk, with those funny doodles on it. "It governs the detonation of mass into pure energy, by cancellation of the paraphysical component. I tried it on that nugget."

He nodded, where that star had been.

"I put the nugget out at space, thousands of miles away, and then I set it off. The light took a little time to reach us, but you saw how bright it was. An eight-ounce supernova!"

He showed her the scrap of paper, triumphantly.

"This is our weapon, Dawn! It's as terrible as Project Thunderbolt —and I don't think Mr. Ironsmith can steal this one!"

She caught an eager breath.

"Then we can help poor Mr. White?"

"I think we can." Claypool nodded his brown head, proudly now. "But there's another thing, that I think we must do first."

She waited, silent in her disappointment.

"We must find that nest of human traitors, first. Ironsmith and his peculiar friends, whoever they are."

"Do you think you can beat them?"

"We must." His wistful face turned thin and grim. "Because they're bound to help the machines, under their Compact. They've always protected Wing IV, and they helped build that new grid, that has got Mr. White. So I don't think we've any chance at all, unless we smash those traitors first."

Uneasily, she peered toward the leaning, dusty splendor of the Galaxy.

"I'm so afraid—of Mr. Ironsmith," she whispered. "'Cause I don't really know him. I liked him at first—when he came with you to Dragonrock. Then he was nice and kind. He talked to me, and he gave me gum to chew. But he's different, now."

She moved nearer Claypool, in the shadowy cupola.

"He seems so terrible now. I 'member when he came to catch us on Wing IV, and he gave us to the machines. He seemed stronger than Mr. White, and I think he knows paraphysics. He doesn't seem a bit like he used to be."

But the little man in the loose gray pajamas stood straight and resolute.

"We've a weapon," Claypool said. "We can fight him now."

XXVII.

Dawn Hall watched the search for the traitors' nest. She watched Claypool sitting in the white pool of light under the shaded lamp, making his strange hasty marks on scraps of paper, and sometimes working his slide rule feverishly and sometimes merely frowning at the leaning silver plume of the faraway Galaxy. She could see his discouragement.

Once he laid his pencil down, and wearily pushed his papers back.

"I can't get it now," he said. "I suppose I need Ironsmith's computing section." She saw the wry,

brief smile that crossed his drawn brown face. "Because he always worked out the beautiful absractions, and I only applied them to reality."

The dim-lit dome was very still, on that windless world where nothing ever moved and night would never end, and she could feel the cruel cold waiting silently, beyond the thin curve of the panels.

"I'm afraid of Mr. Ironsmith." She stood where warm air came through a register, and tried not to shiver. "'Cause he knows paraphysics and he works with the black things and he doesn't seem quite human any more."

Claypool stared at his papers, with brown brooding eyes.

"I could never understand him." Hate whispered harshly in his voice. "Or all the things he has done. But we know he's against us, and that's enough. We must smash him—if we can—however we can."

His thin dark face grinned bleakly.

"I think that little trick of paraphysical matter detonation will surprise him. And I think it will help us force those machines into a new Compact, not quite so unfair, after he and his fellow renegades are gone.

"But we must find their hide-out, first."

"Please," Dawn said. "I'm getting awful hungry."

They went down inside the shelter to the kitchen. Claypool found a loaf of bread and opened a can of meat and made hasty, soggy sandwiches. He washed one of them down himself, and swallowed a dyspepsia pill, and hurried back to the cupola.

He had left Dawn to eat alone, but she followed him anxiously back. She watched him at work until she fell asleep, sitting near him on the floor. She woke again, where he had put her to bed, down in her room in the shelter. Lonely and hungry and troubled and afraid, she came back to watch again.

He looked very tired. His eyes were reddened and hollowed, with dark rings around them. His brown face was thinner, with black stubble growing out on his cheeks. He limped very badly, when he stood up to walk about the little dome. She knew his hope was failing.

She was afraid to talk to him, but she saw his lowering scowls and heard his gloomy muttering. She watched him sweep all his clutter of papers off the little desk, in a sudden fit of impatience. He sat for a long time, just looking out across that black shallow valley. Suddenly, then, he snatched his pencil to set down another careful set of little twisted lines.

"Do you 'member now?" she whispered hopefully.

He shook his head, and she tried not to sob.

"Just one more transformation of the basic equation." He spoke absently, looking toward the leaning pillar of silver fog, that was the Galaxy. "It defines space and time —as effects created by interaction of all the electromagnetic, rhodomagnetic, and paraphysical compo-

nents of wave particles. The equation of clairvoyance, you might call it. Because it explains Overstreet's kind of vision."

She forgave all his scowling at nothingness.

"Then you can see Mr. Ironsmith?"

"I hope so, when I learn how to use it. Because the space factor vanishes, in the transformation, and the factor of past time is nearly negligible. The only actual limit left is a factor of uncertainty, which increases to infinity in future time."

She looked at him, silently reproachful.

"The equation should teach us how to see anything that is happening anywhere, right now," he said, "except that strong paraphysical fields can protect limited areas from search. And we should be able to see things that happened long ago, though that will be a little harder. But things that haven't happened yet will be dim and uncertain, because of that probability factor, and I don't think we can see far ahead."

"Then please hurry," she urged him. "Please find Mr. Ironsmith, so we can help Mr. White."

And he sat behind the little table under the dome, staring wistfully with mild brown eyes at the pale star-mist above the cruel valley. Dawn felt sorry for him again, because he looked so small and frail and worried. He wasn't strong like Mr. White. She saw him rubbing at his bad knee, and she knew his stomach hurt him. But he kept on trying, and at last his brown straining eyes seemed to fix on something in the empty dark.

"Can you see?" she whispered.

"It's hard to do." His voice was slow with effort. "I'm clumsy, yet. The equation shows the method, but I haven't learned the skill. It's hard to focus the perception, hard not to see too much."

For a long time he didn't speak. Dawn watched him, and watched the toppling column of cloud beyond the low black cliffs, and wished he had time to make another sandwich. At last she saw his pale smile of triumph.

"I've found Ironsmith, now." His voice was very low, and she leaned across the desk to hear. "Back at Starmont, when the machines first came. I see him again, and now—"

Claypool shuddered, where he sat. His brown face turned strangely gray, under the stubble of beard. His thin lips quivered and set. His bald head sank a little forward, and Dawn thought he looked as if a knife had stabbed him.

"What hurt you?" she whispered.

His stricken eyes came back for a moment, out of the far nothingness. He looked across the table at her, and gave her a thin, white smile, and straightened in his chair. And his hurt brown eyes looked back toward that slanted pillar of misty light, searching again.

"I saw him with Ruth." His voice was faint and dry, faraway. "That doesn't matter now—except to him and Ruth and me. And it's hard to trace the identity patterns,

where he is teleported. But we'll have to follow him from Starmont."

He sat frowning into nothingness, the way Mr. Overstreet used to do. She watched the changes on his haggard face. A tiny smile made crinkles around his far-gazing eyes, and then they were dark again with dread.

"Please!" she whispered. "What do you see?"

"I've found it." His voice was low and dry and strange. "The den of Ironsmith's renegades." He shook his head a little, peering at that leaning star cloud. "But I don't quite get it! That Compact must be a bigger thing than I ever dreamed. Bigger and older and more evil."

She shivered a little, and watched him. After a long time, his gaze came back from the dark. He drew a long tired breath, and smiled a little greeting to her, and then stood up to stretch. She saw him flinch, when he put too much weight on his bad knee. He still looked troubled and afraid.

"Did you find Mr. Ironsmith?"

He began limping restlessly about the narrow cupola.

"I followed him, and I found the nest of traitors." She saw his bitter disappointment. "But Ironsmith wasn't there."

"Where is he?"

"I don't know." He made a baffled nod, toward that dim, diamond-dusted plume sloping over the black valley. "Still on Wing IV, I imagine. I was afraid to look for him there, because the field potential of that new grid is already pretty strong."

She could see the dark fear that haunted him. But his narrow shoulders stiffened, in the thin gray pajamas, and he looked at her with a hard, bleak purpose.

"But Ironsmith is coming back to the place I found," he said. "In spite of that probability factor, I found the place to wait for him, and I'll be there."

Dawn felt sorry for him again, because she knew he wasn't used to fighting, and she could see how much his knee and his stomach hurt him. But his brown wistful face was sternly set, and she knew he meant to try.

"Where is this place?"

"On another planet, three light-years from Wing IV." He spoke quickly, limping painfully and aimlessly about the little dome. "The renegades seem to be the only people there, and I think the humanoids have paid them pretty high for selling out the rest of us."

His stubbled face was taut and dark and savage.

"Once, I think, the planet must have been depopulated with atomic war—looking back a hundred years in time, I could see only burned ruins, the bomb craters, and sterile wastelands still deadly with atomic residues.

"But the renegades have reclaimed the planet now. The residues are all cleaned up—they must have done that partly with paraphysical means, because radioactives aren't easy to clean out of the soil

and the seas. The craters are level now, and the land is green again."

Claypool frowned into the hostile dark.

"That's a strange thing, these men have done." His skinny fists clenched with bafflement, and relaxed again. "I don't quite see how any man could sell out to those machines, not even for what they seem to pay. Take Ironsmith!"

He scowled at that silver plume of stars, and limped around the dome again.

"I never really liked him much—he always seemed a little shiftless, and somehow irreverent, and too clever for his own good. But I never thought him capable of such absolute wickedness—because this crime is something worse than murder. I'll be there, when he gets back!"

His soft brown eyes smiled at the child.

"You must wait for me, here."

"Oh, please—I can't!" She ran to him, anxiously. "Please let me come."

"You don't understand what I'm going into," he told her softly. "I'm not even sure, myself. But these renegades are strong. They've been working with the humanoids, probably half a century. They must have thousands of men like Ironsmith. I may not come back."

Nervously, Claypool wiped his worried brown face with the gray pajama sleeve, and she pitied him again. She wished that he had been strong and bold and red-bearded, like Mr. White. She knew he was afraid, but he didn't seem uncertain.

"I think I can surprise them," he said. "I didn't see any evidence that they understand mass-detonation. I'm going to try to kill Ironsmith, and the others, and force the humanoids to make a new, just Compact. But something may go wrong."

He licked his pale lips, and grinned at her stiffly.

"I saw no weapons, but such men don't need physical weapons. I don't know what trap they may spring, or what unknown force they may turn against me."

He shook his head, and his soft brown eyes seemed sad.

"So you see you shouldn't go."

"But I must." She clung to his taut fingers, frantically. "'Cause the black things will get me again, if you make me stay."

"Eh?" He blinked at her, startled. "How's that?"

"Don't you know?" She peered up at him, frightened and perplexed. "You should, 'cause you've been fighting the power of that awful new machine, ever since we got away." She shrugged. "I guess you just don't 'member again."

"I didn't know that." He glanced out uneasily at that leaning, frozen plume of far suns, and she saw him shiver. "There must be a lot more in that equation than I can ever learn. But perhaps I know enough to fight Ironsmith—and we'll go to meet him together."

"Oh, thank you!" she whispered. "An' I'm awful hungry now."

They went back down to that white kitchen, which his mind had shaped in the rock. Dawn rummaged eagerly for cans and cartons. He opened them inexpertly, and watched her eat. His own stomach was a raw pain, and he went to his room for another capsule.

The bathroom mirror gave him a shocking glimpse of black stubble and sunken, blood-shot eyes and sick gray pallor, and the loose pajamas made a comic battle dress. He found a crisp new suit in the closet, and tried to change out of the pajamas. He couldn't work the rhodomagnetic snaps, however, and the thin gray cloth proved too tough to tear. He gave it up, and washed his face, and limped wearily back to the cupola.

"It's time to go," he told Dawn, "because Ironsmith will be there in another five minutes, and we must be ready."

She saw him study a scrap of paper.

"Another transformation of the prime equation," he said. "It describes the instantaneous deformation of the electronic exchange forces, by control of the paraphysical component, to transfer the electronic identity patterns of matter to new co-ordinates of space and time. That makes it the equation of teleportation."

Dawn shook her head. She could do teleportation, but she didn't understand the long words or the funny doodles on the paper. Trustfully, she took Claypool's tight, bony hand. He read the paper again, and crumpled it up, and turned toward that high shining cloud tilted across the black sky.

The sky turned bright.

XXVIII.

They were in an enormous room. Great square pillars the color of silver held up the high roof. Between the pillars were wide windows, clearer than glass. The windows came down to the floor, and beyond them Dawn could see this world of the renegades.

Smooth green hills rolled away beneath a soft and friendly sky. The white pillars of other great buildings shone like silver crowns on other hills. Below the hills was a long dazzling curve of white beach, and the sparkle of wind on dark blue water.

Claypool stood beside her, empty-handed and uneasy. A brown haggard little gnome, he looked funny in the loose gray pajamas he couldn't take off. She could see that his stomach still hurt him, and he was very careful of his bad knee.

She knew he was afraid. She wished that he were tall and brave, with fierce blue eyes, like Mr. White. But he smiled at her with his soft brown eyes, and caught her hand again, and pointed toward the open doorway of that vast, silent place.

"Ironsmith will pass by there." His voice, like his hand, was cold and quivering. "We'll be ready."

They started toward the doorway, Claypool limping painfully. Dawn looked around her, wondering at the empty hush of that huge

space. Tall cases of something you couldn't quite see made long rows across the floor, and the cases had things in them. But she couldn't see any people.

"Where are they?"

"Not here." He didn't look at her, and his voice was quick and dry. "Because this is a museum of war. These old weapons must have been collected for historical research, but I don't think the renegades have any use for them. I don't think they'll find us, before—

"Huh!"

She heard that grunt of sharp surprise, and felt his clammy fingers stiffen. He stopped on that vast floor, and blinked unbelievingly at something in a long transparent case, and limped slowly toward it. She peered, bewildered.

Some of the other cases held things she knew. Long black guns, and cruel-bladed knives, and shimmering swords. Curving bows and feathered arrows, and trays filled with keen stone points. But this case held something different.

There was a long thing, made of polished metal. It was sleek and beautiful, tapered to go fast. Spread out beside it were rows of bright parts, all with neat labels that she couldn't read. And there were the curved sections of another shining shell, empty and ready for the parts to fit inside.

That was all, and yet Claypool stood staring speechlessly. He looked bent and empty and sick, and his pale dry mouth was drawn by the hurting in his stomach. She pulled at his hand, whispering:

"Please—what is that?"

"Those are my missiles." His voice was a shaken rasping. "From Project Thunderbolt! I thought Ironsmith took them, but I never knew why." His brooding eyes held old hatred, and dull bewilderment. "Here they're only laid out to rust, along with throwing sticks and primitive plutonium bombs. I don't quite get it!"

He shrugged nervously, and limped away again toward the wide door where Ironsmith was to pass. Clutching his cold hand, Dawn hung back to watch a tiny flying thing.

It must have strayed in from the green fields, she thought. It fluttered idly above a case of long black spears, on rainbow-colored wings. It hovered and perched and preened itself, and Dawn thought it was entirely lovely.

Then she felt the cruel sudden tension of Claypool's clammy fingers. She saw a hard white flash where the winged thing had been, and she heard a clap of sound. Her nostrils caught a sharp burnt odor, and she saw the bleakness of Claypool's haggard face.

"Did you do that?" she whispered.

She saw a new gray sickness on his face, and the beads of sweat on his furrowed brown forehead. His lips turned white from the hurting in his stomach, and he nodded.

"I wanted to test the detonation equation again," he said. "And I guess that butterfly reminded me of Ironsmith—so lazy and idle and brilliant."

She was sorry he had killed it,

because it had been a perfect thing. But she felt sorry for Claypool, too, so sick and desperate and afraid. He caught her hand again, and hobbled on laboriously toward the open doorway.

"We'll wait here, for Ironsmith."

And he stopped her behind the gray ugly bulk of a battle tank, the thick steel of it scarred where bullets must have struck it, and black where flame had burned it. Silent and afraid, she watched the doorway.

Broad steps, outside, led down to curving walks and broad green lawns. Beyond a clear stream, the grass was scattered with strange low trees, bright with violet bloom. A man and a girl were walking there—the first people she had seen.

They looked happy and brown and strong, and the girl wore flowers in her hair. They held hands, and she heard a ring of laughter. They were alone, with no black things to guard them—although, on another far green hill and small as a toy in the distance, she could see the black, pointed pillar of a ship which must have come from Wing IV.

Claypool drew her back beside him, crouching lower behind the burned armor of the tank. She felt his wary tenseness, and saw the hard resolve in his narrowed eyes. A sudden alarm made her clutch at his sleeve.

"Please don't hurt them," she whispered, "'cause they look so happy!"

"They are the enemy."

His voice was flat and cold, and something in it made her shiver. She looked at him—a sick, stooped little man in gray pajamas. She pitied him, yet she knew that his mind was deadlier than all the weapons in this museum of death.

"It's hard . . . to understand." She heard the haunting trouble in his voice. "They do look happy. But they've joined the humanoids, and sold us out. I can hear them laughing now, but their crime is the worst I know. If they find us, I'm going to kill them."

"Then I hope they don't."

Dawn shivered. When she looked again, the man and the girl were putting up a gay-colored building, beyond the stream. She watched them at work, puzzled. She knew they hadn't brought anything with them, and she couldn't see any black machines helping. They drew the bright sections out of the stream and fitted them very swiftly together. She realized suddenly that they were building a shelter out of water, with their minds.

Beside her, Claypool stiffened suddenly.

"Dawn!" he breathed harshly. "Quiet!"

Crouching behind the war-scarred tank, she saw an old man coming up the broad steps outside. Tall as Mr. White, he was lean and straight, snowy-haired. His cragged, rawboned face had a look of austere command, and his gnarled old hands hung a little forward, in an attitude of competent readiness for anything.

Dawn hadn't seen him come. She looked beyond him, for the vehicle

that must have brought him, and found nothing. He came to the broad level at the top of the steps, and looked around him, and waited there.

Beside her, Dawn could feel Claypool's trembling tensity. She saw his brown eyes, hard and narrowed again, watching the old man. She saw the bright sweat on his twisting cheeks, and his sallow illness, and his twisted frown of pain. She could feel his deadly readiness, and she was glad when the old man didn't find them.

She didn't want to see him die.

Waiting, the old man walked idly to a low silver parapet. He seemed vigorous, and he didn't need a cane. The man and the girl saw him, and waved to him from the shelter they were building. He lifted a great scarred hand, in majestic salutation. Suddenly he smiled and turned, and Dawn saw the man he had waited for.

"Now!" Claypool made a sob of triumph. "He's come!"

Still she saw no vehicle, but Frank Ironsmith came quickly up the museum steps, smiling and holding out his hand to grasp the old man's. His sandy head was bare, and his pleasant youthful face was bright with a quiet elation.

"Mr. Sledge!"

Dawn heard him call that eager greeting, and she felt Claypool start. She remembered Mr. White's talk of old Sledge—the unlucky old man who made the black things, and then fought them, and was beaten. But this couldn't be the same Sledge, she thought, because he couldn't be that old, and he didn't look beaten.

"Well, Ironsmith?" The old man's voice was an anxious rumbling. "How's your grid?"

"Done!" They shook hands, beaming. "I just watched the humanoids hook in the last section. They're going after Claypool with it, as soon as we get enough potential up. I don't think such cases will be dangerous, any longer."

Claypool shuddered. Dawn saw the scowl of effort on his haggard face, and the terrible light in his sunken eyes. She knew he was about to strike, and she huddled lower behind the old tank, to escape the fury that would be loosed when Ironsmith died.

But he didn't.

She saw the deadly purpose relax from Claypool's dark hollowed face, and she heard the dreadful pain in his stifled whisper:

"No—not Ruth!"

Impelled by wonder stronger than her terror, Dawn rose up again, to peer over the fire-scarred tank. She saw a woman, tall and smiling, coming to join the two men. The woman, she thought, was altogether beautiful. Her hair was red-glinting black, and her gown was crimson-and-black, and her white face was joyous.

"My darling!" she cried. "So you're home!"

Ironsmith ran down the steps to meet her. Her long white arms opened for him, and her bright lips parted for his kiss. He gathered her against him, and then Dawn

heard the broken moan of the drawn little man beside her.

"That was—my wife."

XXIX.

Behind the tank, Claypool came stiffly to his feet. Under the untidy black stubble, his gaunt face was livid with his agony. His stringy fists opened and clenched and opened again. He stumbled to the doorway of that hushed museum of weapons, hobbling painfully on the leg the humanoids had set, and he stopped between the silver pillars there.

He must have forgotten Dawn. She ran after him, too frightened to whimper. She was afraid of the pain and the fury on his quivering face, but she was more afraid of the others outside. They were the friends of the black things. She caught up with Claypool, and clung to the flapping folds of his gray pajamas.

Outside, the tall old man stood with his back to them, smiling down in fond approval at the two below him on that wide silver stair. They straightened from their long kiss of greeting. The woman let Ironsmith go reluctantly. He brushed her soft hair with his fingers, and murmured something, and she whispered softly:

"Oh, my dear, I'm so glad you're home!"

Claypool shuddered, and made a strangled cry.

"Ruth!" he shouted hoarsely. "Get away from him!"

They all swung to face Claypool then, seeming a little startled. The old man's seamed and cragged face took on a look of stern regret. Ironsmith stood with his arm around the woman, calmly grave. A shocked pity widened the woman's eyes.

"Webb!" She seemed breathless, hurt. "What . . . what are you doing here?"

Claypool limped toward them, trembling violently. His hollowed face was bloodless. He swayed weakly, and his bad leg tried to buckle under him. He got back his balance awkwardly, and caught a ragged breath. Dawn crept after him, silent and afraid.

"I'll tell you!" He spat the words, with a tight-voice vehemence. "And I think you had better listen, because I can follow you across the universe, if you try to run away. You see, Ironsmith, I've a better weapon now than the clumsy device you stole."

His bald head jerked scornfully toward the long case behind him, which held the useless missiles of Project Thunderbolt, built to shatter planets. And then he pointed, with a thin shaking arm, out across the scattered silver buildings on the hills, toward the estuary.

"See!" he rasped. "Watch that rock!"

Trembling beside him, Dawn shaded her eyes to peer out across the wind-ruffled indigo water. Where it met the limpid sky, she found a far wisp of white water and a tiny point of black. Claypool gestured angrily at that rock, and it turned to incandescent fury.

The light of it might have been

blinding, but Dawn guarded herself. She watched the appalling dome rush outward, and the terrible white flame of it soften at last into flowing, rosy colors. She saw the great cloud of fire and darkness mushroom upward to stand like an ominous signal against the peaceful sky. Presently the floor shook.

Dawn had been sorry for Claypool, but now she clung to his thin gray sleeve, smiling up at him proudly. Now his bad knee and the hurting in his stomach didn't seem to matter, for even Mr. White couldn't blow up rocks like that.

Strangely, though, the three before them didn't seem afraid. The old man shook his cragged, white-maned head, in regretful protest.

"You shouldn't have done that," he rumbled sadly. "Seafowl nested on that rock."

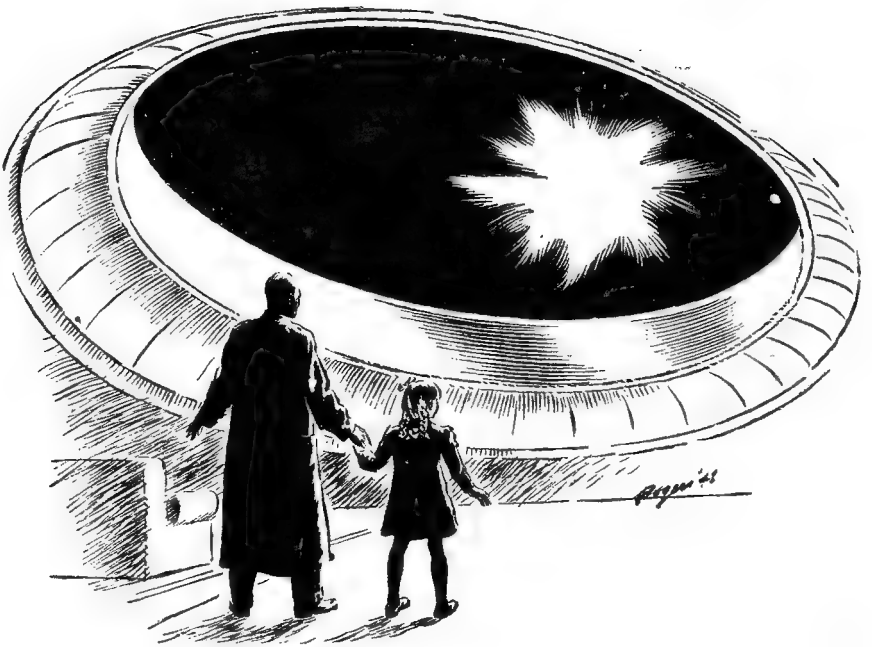
Ironsmith stood calm and bold and very grave. Ruth stood beside him, and watched Claypool with a stricken pity.

"Webb!" she whispered again. "What do you think you're doing?"

"I know what I'm doing." Claypool limped grimly toward them. "I'm going to smash your dirty little plot with the humanoids—this monstrous Compact to smother and mechanize the human race. I'm going to give all men, everywhere, the same freedom you've sold us out to get."

He swung violently upon the sober man beside her.

"Ironsmith, I'm going to kill you. I'm willing to bargain with the rest, but I think you've a little too much



to answer for. Have you anything to say?"

Calmly, Ironsmith said: "You might specify your charges."

"You've turned against your kind, and joined the mechanicals," Claypool rapped. "You spied on me, and sabotaged Project Thunderbolt, and betrayed White, and wrecked our last effort to change the Prime Directive. Now you've helped build this new grid, to run men like machines."

Claypool gulped, and tried to lower his voice.

"Those are the crimes I know, I don't know how long you schemed to take my wife away—" He swallowed hard, and Dawn saw the spasm of pain that crossed his face. "But I think those are proven charges enough. Now are you ready to die?"

Claypool paused, swaying on his bad leg, gasping heavily. He waited, but Ironsmith didn't answer. He turned back to the woman, with agony twisting his face.

"Get away from him, Ruth!" His voice was flat and breathless. "I don't want to hurt you—whatever you may have done. But I'm going to kill this traitor, and you'll be hurt if you stand too near."

The woman didn't move.

"Please, Webb—don't be ugly!" Her low voice seemed distressed. "We can help you, if you'll only let us. But please forget your silly threats—because you can't hurt us, Webb."

He flung out his skinny fist, and she insisted sadly:

"You can't harm us, really."

She glanced at the calm man beside her. Dawn saw the glow of devotion that lit her dark eyes, and the deep pity that shadowed them when she looked back at Claypool.

"Please try to see it all our way, Webb," she begged, "because there's nothing unfair about Frank, and there's no one you can really blame except yourself—and Project Thunderbolt!"

Dawn saw the glint of tears, in her dark eyes.

"I'm sorry for you, Webb, and I used to be sorry for myself. That planet-bursting toy of yours was a monstrous thing, and yet I think you really loved it. I know it left you no time to think of me."

She tried to control her low, trembling voice.

"Please, Webb—don't blame Frank. He only took me away from Starmont after you had abandoned me, drugged with euphoride, when you wandered away on your insane adventuring. He brought me here, and woke my memory, and we've learned this new way of life together."

She looked at Ironsmith, and Dawn saw her deep joy.

"We're in love, Webb." Something made her flush. "It's all legal. I didn't know where you were hiding—we couldn't find you for the formalities. But Frank and I are married, now. I . . . I hope you'll try to wish us well."

Dawn saw her white throat pulse. "Won't you, Webb?"

Clinging fearfully to Claypool's thin sleeve, Dawn felt him stiffen.

She heard his tortured, sobbing cry, and saw the gray, sick fury on his face. She cowered back behind him, and flung up her arm to shield her eyes from the flame of annihilation.

She knew he meant to kill them now.

She waited, shuddering, but nothing happened to the man and the woman. The mass of their bodies wasn't detonated into dreadful flame. They didn't even fall. They merely stood there on the silver steps, Ruth shaking her lovely head in sad reproof.

"Huh!"

Claypool gasped with disbelief and pain, as if some unfair blow had wounded him. His wide, hurt eyes went back to the horizon, where that ominous mushroom of cloud was still dissolving in the summer sky. He seemed to search for another rock.

"Hold on, Claypool!" that gaunt old man broke in hastily. "There's no use wrecking all the landscape. Because you can't hurt anybody—not with paraphysics."

Claypool blinked at him, swaying and ill.

"Seems you must have overlooked a couple of basic fundamentals," old Sledge murmured softly. "In the first place, as you should have learned, the paraphysical functions are normally unconscious—they belong largely to that great fraction of the brain tissue which lies outside the area of conscious thought. And the savage conflicts in such a sick mind as yours make a difficult barrier to any conscious paraphysical control."

Claypool stood silent, shuddering.

"The astounding thing is that you accomplished all you did," the gaunt man said. "But I've known other cases of paraphysical compensation for physical handicaps, in individuals under great stress. And you had an advantage, of course, in your sound grasp of the physical and mathematical side of the problem."

Claypool stood numbed and stupid-seeming with his pain.

"Yet, for all you've done, you have no real understanding." Sledge shook his cragged head. "You've just proved that, with this insane effort to murder Frank Ironsmith. You should have learned, long ago, that paraphysical energy cannot be used for such destructive purposes."

The old man spoke with a careful patience.

"Because it's creative—the basic creative element of the universe. It builds stable atoms, out of disruptive electrical particles. It controls the shaping of planets, out of exploding nebular gas. It kindles life. It is the driving force of evolution.

"And it *is* mind."

Claypool felt groggy with fatigue and grief and shock. Slow throbs of pain stabbed through his swollen knee, and small fangs of hungry agony nibbled at his stomach. But he shook his head and tried to listen.

"Mind is the ultimate paraphysical phenomenon," the old man said patiently. "It is an emergent function of the paraphysical components of the atoms in the brain tissue.

Each atom has mentality to the tiny extent of that component, and every molecule has more. The human mind is simply a new integration of that creative force, on a higher level."

Claypool wanted to listen, but the warm air seemed suddenly oppressive. Sweat began to trickle down his forehead and his flanks, and something squeezed his chest, and his knee tried to buckle. He staggered, on the silver steps.

". . . sick man, Claypool," Sledge was saying. "You're killing yourself. Because life and mind are creative. When you try to turn them to ends of destruction, you set up inner conflicts which destroy your own identity. A mind, like an atom or a star, can be shattered by the failure of the paraphysical component."

Claypool swayed again, and the tall man steadied him.

"Better sit down."

Dazedly, aching all over, Claypool sat down on the broad silver stair. A cool breeze struck him, from the far blue estuary. Wet with nervous perspiration, he began to shiver in the thin pajamas. Some stray pollen grain gave him a fit of sneezing. He blew his nose, and tried to listen.

"Full conscious control of the paraphysical functions requires a whole mind," Sledge told him softly. "A mature and integrated personality, free of inner strains. No man who has found that mental peace would attempt to kill another. No man who has not would be able to—not paraphysically—because that energy is creative, and it will not destroy itself.

"Now, do you see why you failed?"

Claypool nodded heavily. He felt drugged and drowsy with the poisons of fatigue, and pain, and sheer defeat. But he tried to understand.

"You imagined you were fighting for the good of mankind," Sledge went on. "That creative purpose—however mistaken—must account for what you did accomplish. I imagine you were quite successful, so long as you limited your efforts to constructive projects."

Claypool peered up from where he sat.

"That's true," he said faintly. "I think it explains the most astounding thing. When we escaped from Wing IV, you see, we somehow got to a dead planet, lost outside the Galaxy. Somehow I built a shelter for us there—or Dawn said I did." Haunting wonderment whispered in his voice. "I could never remember."

The gaunt man nodded his white mane.

"A creative project. Therefore, no conflict existed. Imagined danger to the child was the stimulus. The unconscious function made use of your conscious knowledge. But your attack on Ironsmith was destructive, and the utmost folly."

Claypool shivered in the breeze, and sneezed again. Dawn stood close to where he sat, whimpering silently. He knew she didn't understand, and she was still afraid. He

put out his stringy arm, and drew her to him.

Ironsmith and Ruth stood below them on the silver stair, hands clasped. Claypool looked down at them with an apathetic envy. They stood so straight, so pink with health and joy, so serenely absorbed in one another. Aware of his sullen gaze, they came toward him up the steps.

"So you can't hurt us, Claypool." He winced from Ironsmith's cheery calm. "Because paraphysical energy creates, as surely as masses gravitate. I might have taught you that, long ago—if you had been a little less absorbed in Project Thunderbolt."

Claypool sat cold and silent, too ill to hate them now. His clammy arm drew Dawn a little closer, and he felt her tiny fingers touch his stubbled cheek, sympathetically. That little act of compassion made an ache in his throat, and blurred his eyes. He wiped his face angrily, with the gray pajama sleeve, and sat staring at the tall stranger who had been his wife.

The cold breeze brought him a hint of her perfume. The thin clean fragrance of it was laden with crowded memories, bitterly sweet, of their home at Starmont and the lost closeness of their love and their honeymoon by the sea—interrupted by the cold blue flare of the Crater Supernova.

"Please, Webb—try not to hate us so!" The pity in her voice cut him with a thin pain. "Because your mind is sick, and hate is part of the sickness, and you can't get well unless you try to cure it."

Heavily, Claypool shook his head. He didn't really hate her now, because the past was gone and dead. He was even glad to see her glowing joy in Ironsmith, because she had a right to happiness.

But he didn't want to hear her voice again, or smell the musky scent of Sweet Delirium. Bleakly, he muttered:

"Sure, Ruth. I understand."

"Thank you, Webb!" Her quick little smile hurt him with too many memories. Her throaty voice held a soothing comfort, as if she spoke to a suffering child. But Claypool looked away from her. He wanted nothing from her now.

"I think we can help you, Webb," she was murmuring softly, "with Frank's new grid."

"Huh!"

Taut with protest, he came to his feet on the silver steps.

"What do you mean?"

Still absently holding the woman's hand, Ironsmith looked at him with gray, candid eyes.

"Yes, Claypool, I think the new grid can cure your troubles," he promised softly. "It is designed to handle just such cases as your own, where partial knowledge and inadequate power and mistaken resentments have become too dangerous."

Claypool was shuddering, washed with a sudden black and chilling tide of recollection. He remembered four human machines he had seen marching too swiftly and too gracefully across that dark labora-

tory under the grid, deaf and blind and smiling.

He didn't want any help from Ironsmith's grid.

The serene gray eyes of the younger man were looking past Claypool, as if he saw something far beyond the silver pillars and the vast crystal windows of the war museum. His smooth pleasant face smiled a little, and his sandy head nodded, and then his eyes came back.

"The grid will be ready for you soon," he said. "The last sections have been connected, and now the paraphysical potential is building—"

Convulsively, then, Claypool broke free of the terror which held him. Beside him, Dawn was whimpering softly in her bewildered fright. He picked her up in his knobby arms, and fled with her up the broad stair, toward the museum door, and the crystal case that held a sleek and dreadful missile.

XXX.

Beyond the silver columns, that huge hall lay hushed and dim. Near the scarred and blackened tank, he could see the unguarded case that held the stolen relics of Project Thunderbolt. The long missile itself would be impossible to launch by hand, without special tools to set the controls and start the drive; but he had seen the heavy little cylinder of a detonator, among the labeled parts of another war head, displayed beside it.

That detonator would be enough.

"Listen, Dawn!" he rasped hoarsely as he ran. "I want you to go away—back to our shelter. I think you'll be safe—because I'm going to blow them up."

She squirmed in his arms, protestingly.

"Please—don't!" she sobbed. "'Cause they aren't really bad."

He almost paused, but sheer terror drove him on. He didn't want to be a flesh machine, safely run by Ironsmith's grid. His knee was shuddering under him, and Dawn seemed too heavy in his arms. But he came to the top of the stair, and staggered between the shining pillars. His anxious eyes found the white palladium cylinder of the detonator in the case—smaller than his stringy fist, but big enough.

He glanced back fearfully, but the three behind had not moved to interfere. Perhaps they hadn't guessed his desperate plan. Or perhaps their paraphysical powers, like his own, were useless for violence. They merely stood watching, Ruth with a sick pity in her eyes. He was suddenly sorry she must die.

"Please!" Dawn was whispering. "Please don't—"

Then his foot struck a raised threshold, between the silver columns, which he hadn't seen before. He tried to catch himself, but his bad leg folded. He fell, trying to shield the child. His head struck a corner of the tall crystal case that held the tank.

For a moment he merely lay there, limp and dazed. Dawn knelt by him, crying. At first he thought she was hurt, and then he felt her trying to lift his bursting head. He

tried to get up, and felt a sickening stab in his knee.

"Better wait, Claypool," old Sledge boomed gently.

Laboriously, he pushed himself up on his elbows, and hitched himself backward, and propped his body against the shining case. The corner of it had cut his scalp, and he felt warm blood in his thin hair. Slow waves of pain surged through him, but he tried to grin at Dawn's tearful face.

"Last try," he breathed. "Nearly . . . made it."

He tried to hitch himself a little higher, and great breakers of agony hammered him back down again.

"Lie still, you blundering fool," Sledge told him softly. "You've made mistakes enough. You'll have to let the grid take over, now, as soon as we get the potential up. Perhaps it can manage your body a little more efficiently."

He saw the old man dimly, then, following through that wide portal with a vigorous stride—and now there was no longer any lifted threshold, where he had tripped. He looked bleakly for Ironsmith and Ruth, but they had vanished from the silver stair.

"They went back to Wing IV," Sledge told him, "to get that potential up."

He lay propped against the slick crystal, cold with despair. Blood made a sticky rivulet down his stubbled cheek, and dripped on the gray pajamas. He saw the terror on Dawn's grimy face, and her stout effort to stop her tears.

"I felt the grid once," she whispered bravely. "It isn't really bad."

"Not bad at all!" old Sledge told him heartily. "On the contrary, it is built to cure all the destructive conflicts and compulsions of such unfortunate individuals as you are, Claypool. It will be good for you, and you should be grateful for it."

Claypool blinked at him, bitterly. The trial, he knew, was over. The verdict was guilty. The sentence was death—by a special kind of gallows, that made a puppet of the victim. Now he was waiting for the hangman.

"I can understand your misdirected motives, Claypool." The old man's cragged face seemed honest now, and even kindly—as if he felt apologetic for a sentence too severe. "Because I shared your insanity, once. I once fought the humanoids, and tried to alter the Prime Directive."

Claypool tried to lift his head, and waves of pain forced it back against the case. A weary detachment had come to end his passion, and even a dull relief that his long battles were ended. But he had never solved the monstrous riddle of these renegades, and now a dull wonder struck him.

"Sledge! Are you—*that* Sledge?"

The old man nodded serenely.

"I built the humanoids, nearly ninety years ago. To stop the self-destruction of mankind. I built the Prime Directive into the relays at the Central, and protected it from change—and then tried mistakenly to change it."

Old Sledge sighed.

"I made the same blunder you have made. I had no philosophy. Egotism ruled me, instead of intelligence. I wanted freedom, before I had earned it. I was stupid and blind enough to fight the humanoids. Thirty years ago, I tried to blow up Wing IV with a rhodomagnetic beam. Fortunately, I failed."

Beyond the gaunt old man, Claypool could see a long tapered missile in a crystal case, and a little silver-colored cylinder on a tray beside it. He tried to lift his body again, and pain staggered him.

"Don't move," old Sledge said softly. "Just wait a few minutes longer, and Ironsmith's grid will pick your body up. It can heal everything that's wrong with you. I wasn't quite so lucky, thirty years ago. Then there wasn't any paraphysical grid."

"Eh?" Claypool caught his breath, and tried to ease his knee. "White told me how the machines exiled you from Wing IV, and drove you from planet to planet. You must have hated them then?"

The white head nodded gently.

Bleakly scornful, Claypool whispered his challenge:

"Then tell me why you sold out!"

"I didn't." The old man stepped a little nearer, smiling calmly down from his straight height. "I just—changed. Let me tell you how it was. Perhaps I can help you to welcome the grid."

Grimly, Claypool tried to shake his bursting head.

"Thirty years ago," Sledge repeated softly, "there wasn't any grid. When the humanoids finally caught me, after my last defeat, they operated on my brain." His raw-boned face smiled a little, proudly. "I had made them well. They were clever surgeons, even then."

"Operated?" Claypool said. "For what?"

"They removed the conflict and the hate that were causing my troubles. Also, to protect the Prime Directive, they took a part of my memory. So, with the knife—and I think some use of drugs and suggestion—they gave me freedom."

Claypool tried to lift himself, and hurt his knee again.

"So?" he muttered bleakly. "And how did Ironsmith get his? I always wondered what kind of ugly deal—"

"There aren't any deals," Sledge told him. "The humanoids are simply excellent psychologists. They were always able to distinguish those who needed watching, from those who didn't. Your own destructive complexes must have been instantly apparent to them, and they could easily see that Ironsmith was harmless."

Harmless? Claypool blinked at that, bitterly. That pleasant-faced and honest-seeming rogue had sabotaged Project Thunderbolt, and turned against mankind, and eloped with Ruth to join these vicious renegades. But the dull waves of pain were surging stronger, beneath his matted hair, and he felt too weak to protest.

"They left me free, soon after that operation," old Sledge rambled

happily on. "They even let me carry on my research. The physical sciences were still out of bounds, of course, because most of the equipment is pretty dangerous, even for mental adults. But there was paraphysics.

"Before, I had always been a skeptic—with that conscious denial of paraphysical phenomena which usually results from buried, destructive conflicts against the creative, unconscious paraphysical urge. I even remember quarreling with poor White, about his fantastic plan to fight the humanoids with paraphysical weapons.

"But that same clean blade, removing those conflicts, had also liberated my repressed paraphysical powers. The telepathic function came first, and I was soon in contact with a group of philosophers here."

"Philosophers?" Claypool rasped his savage challenge. "Or traitors?"

Smiling, the old man gestured through the white-pillared doorway, at the soft green land without, the clustered silver towers crowning gentle hills, and the blue, wind-glittering estuary.

"Does this look like a den of turncoats?" he asked softly. "No, Claypool, this is the Paraphysical Institute. A few adult and brilliant men formed it, nearly seventy years ago. The humanoids had released them from their physical cares and their preoccupations with physical science, and they turned their minds naturally to philosophy.

"The humanoids left them free to work, and even aided them—the Central is a deep reservoir of knowledge, and an infallible mathematician. They won a new understanding of man, life, and the universe. That new philosophy became the basis of a new psychology—an actual science of the mind.

"Those pioneer philosopher scientists were looking for truth, and they found it. They weren't much interested in such spectacular stunts as telurgy—"

Claypool blinked, and the old man explained:

"That's the term for mental transmutation of mass—the same art you used, unconsciously, to build your shelter. The paraphysical mind, you see, is linked to the paraphysical component of every atom—to the functions that mathematicians used to misname probability. Anything material can be changed to nearly anything else, by control of the exchange forces to reshape electron-identity patterns. All such tricks, to those philosophers, were merely incidental by-products of truth.

"Yet such new devices of conscious control were useful, even to them. Scattered over many planets, they discovered one another by telepathy. Teleportation brought them together, to join their efforts. Clairvoyance soon warned them of the mounting danger to Wing IV, from such dangerous fanatics as you are—and I was, then."

Sledge shook his white, flowing mane, regarding Claypool sadly.

"That was the origin of the Compact. Warned of those future dangers, the humanoids agreed to

support the Institute, in return for the aid the philosophers could give them toward achieving the real purpose of the Prime Directive."

Claypool heaved his shoulders a little higher against the crystal case, and reached gingerly to touch his throbbing, puffy knee. He set his teeth against a sob of pain, and his fevered eyes went back to that bright little cylinder of palladium, which was heavy with a planet's fate.

Sledge must have seen the glance, for his own eyes swept that dim vast hall, with its cases of wooden spears and guided missiles, of blowgun darts and biotoxin ampules, of flint points and radiotoxin disseminators.

"The museum is part of the Institute," he commented. "A good many of the exhibits came from this very planet—tokens to keep us from forgetting the old enemy that is born again with every human being.

"For life hurts every man," he said. "Those wounds must heal, before any man is a sound adult. Some recover easily, most carry their scars forever, and a rankling, unfortunate few are never well again. The true goal of our new psychology has been to mend those injuries, safely and surely, without pain. I think Ironsmith's grid can do that."

Claypool had tried to listen.

But his knee was paining, and his head throbbed under the clot-stiffened hair, and he was ill with the old agony of his angry stomach slowly digesting itself. He hitched himself up against the case again, and peered wistfully toward the bright little detonator.

"You see, Claypool, the advent of the humanoids forced a very useful change in the direction of human progress. Technology had got out of step with mentality—the technicians were putting such deadly toys as Project Thunderbolt into the hands of mental savages.

"I made the humanoids, to put a period to that. The technicians—with the very best intentions—had wrecked the balance of civilization. It was breaking up, like an off-center flywheel. The humanoids simply forced the technicians to take a holiday, until the philosophers could restore a normal equilibrium.

"Such men as you and White never accomplished much at paraphysics, because you weren't philosophers. You were motivated by hate—the very antithesis of the creative paraphysical force. You didn't care about the basic truth, but only tricks that you could turn to weapons—and you didn't even learn that paraphysical weapons are inherently impossible.

"Ironsmith, now, is the type of man who made the Institute." That cragged face smiled gently. "I don't imagine he won any great success, back at Starmont. Because your true philosopher is free of such dangerously destructive drives as excessive ambition. Probably you considered Ironsmith something of a bum."

That point, at least, Claypool could grasp.

"Completely worthless." He tried

to grin through a haze of pain. "Except he was good at math."

"But he found himself, when the humanoids came. They saw he had no harm in him, and they left him free. As soon as they learned of his interest in paraphysics, they put him in touch with the Institute—he used to play chess with me, when he was practicing telepathy. And he has turned out to be a brilliant paraphysical engineer, with this new grid."

"So now he's making nice, safe mechanicals out of all mankind!"

"Won't you try to understand?" the old man begged. "Can't you see that any society must discover and control and reclaim maladjusted individuals—before they destroy others or themselves? That's the function of the grid."

Claypool shook his head, because it hurt too much to think.

"I saw White, under the grid." His whisper came laboriously, for even speech was painful, now. "A neat machine—smiling out of some cold hell. I don't want to be another mechanical—run by those relays. I'd rather—"

His whisper failed, but his burning eyes clung to that bright detonator in the case beyond his reach. His blood-stiffened fingers itched to feel the cold weight and the ultimate, conclusive power of it.

"You still don't understand," old Sledge chided softly. "Ironsmith's grid is no independent monster, such as you seem to fancy. It's merely another tool, like the humanoids, built to serve mankind.

"I think you're physicist enough to see that the residual field of all those platinum relays would still be too weak to coerce one unwilling moron. The grid is only an efficient instrument, built to focus and apply the unconscious paraphysical energies of all mental adults, everywhere.

"The new grid is no mad mechanical brain, Claypool. It is only a convenient vehicle for the racial human mind. It is the instrument for a new level of intelligence. It can't be evil or destructive, because its very nature is creative. It isn't authoritarian, as you seem to fear, but democratic. Every mental adult will have an equal part in the unconscious direction of it."

Old Sledge's voice was booming now.

"This full emergence of the group-mind is a magnificent stride, Claypool, in the long evolution of intelligence in the universe. It follows the gradual birth of life from lifeless atoms, and the rise of the individual mind from life. Who can say where it will lead—to what new creation of the paraphysical component, which is present in every atom, and which is forever building atoms into higher syntheses, on higher levels of creative evolution!

"Man was sick, Claypool. He was very close to death—with his runaway physical technology killing him, like the runaway cells of an organic cancer. But the humanoids removed that cancer, efficiently I think, and now Ironsmith's grid will provide a new control, to assure a

balanced growth and cure any unhealthy cells. That social cancer won't come back.

"There'll be no more wars, no more killing—"

The old man broke off suddenly, then, and turned with an expectant smile. Painfully turning his head, Claypool saw Ironsmith striding briskly in between the tall silver columns.

"The potential's finally up," he murmured brightly. "Ruth stayed to watch the meters."

Claypool stiffened. His pain-wearied brain hadn't followed all the argument, but he knew the case was closed. He was condemned, and here came the cheery hangman. Ironsmith grinned pleasantly.

"Ready, Claypool?"

XXXI.

Sprawled against that crystal case, with the frightened child beside him, Claypool didn't try to answer. He lay watching that white cylinder he couldn't reach, enduring the slow thudding in his blood-matted head and the tight constriction of his knee and the gnawing fangs in his stomach, waiting for the power of the grid to blot out his conscious being.

Dawn's whisper startled him.

"Please—I can help you now!"

And he felt her leave his side. He glimpsed her standing in that tall, transparent case, tiny beside the long bright missile from Project Thunderbolt, stooping to pick up the detonator from the display of labeled parts. Then she was back again, instantly, thrusting it into his hands.

He took the heavy little palladium cylinder. His blood-stiffened fingers moved with an automatic skill, stripping out the safety keys. He set his trembling thumb on the firing bar, and sobbed to the white-faced child:

"Thank you, Dawn—now save yourself!"

He saw her black head nod, still proud with that crumpled scarlet ribbon. His shuddering thumb came down, in an act of blind rebellion against the black mechanicals and the grid, in a last savage stroke against Ironsmith's pink-faced, intolerable rightness, against the very pain that racked him.

He tried desperately to push home the bright little palladium bar, that would convert all mass within forty yards—the rusty tank and the museum floor and his own sick flesh—into energy to crack the planet. The bar moved easily, and he felt the spring begin to yield.

Yet something stopped his thumb.

He couldn't understand it. He had scarcely listened, in his hopeless torment, to the old man's ramblings. Still he hated Ironsmith, for spying on him, and wrecking Project Thunderbolt, and stealing Ruth away. He was beaten, and here was a way to die magnificently.

Yet something in him wouldn't press that bar.

"I can't—" he breathed to Dawn. "Please put it back."

Carefully, he slid the two safety keys back into place, and gave the useless cylinder back to the child. She took it, puzzled and hurt, and left his side again.

Stiffly he turned his head again, to peer up at old Sledge and Ironsmith. They stood where they had been. They were smiling at him, and they hadn't tried to interfere. He hated the old man's rawboned, kindly honesty, and Ironsmith's smiling, sunburned calm.

"Go ahead," he muttered bitterly. "I'm ready now."

And the strength fled out of him. His body slumped back against the shining crystal. His drawn, brown head dropped down on his arms, smearing the thin pajama sleeves with tears and sticky blood. He lay there quivering stiffly to his sobs of failure and final self-defeat, waiting for the power of the grid.

Dawn replaced the detonator in the case with the other labeled bits of shiny metal. She had caught the savage force of his longing for the weapon, and she couldn't understand why he hadn't used it. Dismayed, she came back to where he lay.

"Please," she choked, "couldn't I do anything?"

Anxiously, she touched his bent shoulder, where clotting blood from the long gash in his thin-haired scalp had plastered the gray pajamas down to his flesh. But he ignored her voice and her touch. He lay with his bitter face buried, crushed and broken and alone.

She saw the grid take him.

A new tremor shook him, as if he fought it. Then his sobbing stopped. For a little time his sprawled body lay very still. The ragged cut in his brown scalp seemed to close itself, and the bleeding ceased.

Then he sat up, moving stiffly at first and then very quickly. He put both hands on his swollen knee, and carefully straightened it. Some-

thing made a loud snap, which startled and alarmed her. And then he rose.

That quick gliding movement showed no fatigue, nor any human awkwardness or pain. He was careful of the injured knee, but even the way he guarded that was lithely graceful—for he was like one of the black things, now. She knew that nothing hurt him any longer, not even his stomach, for he was smiling now.

Cold fingers caught the back of her neck, when she saw that smile. For the man Claypool, with all his fears and his tortured hopes, his kind impulses and his cruel conflicts, was gone from behind that stubbled, hollowed, dark-stained face.

He was smiling. But those haggard, distended eyes saw nothing. He didn't know her, any longer. He didn't know anything. That smile showed no human feeling. Beyond the tears and the beard and the drying blood, it was terribly far and calm and empty. It was mechanical.

"No!" she moaned. "Oh—no, no, no!"

And she cowered back from the human thing that smiled. It didn't see her with those dilated eyes, but it had no need to see. For it turned upon her, still protecting the hurt knee but moving with a machine's sure precision, and it spoke to her.

"At your service, Dawn Hall." Its voice still had something of Claypool's, yet it had become a high, droning monotone. It was somehow melodious, and quite without feeling. "Do not be afraid," it whined. "No harm will come to you, but you also require the care of the grid."

She cowered back against the crystal case, away from that mechanized thing. But it ceased to move, like a stopped machine, with that cold, calm smile frozen on its blood-streaked face. Ironsmith came quickly up beside it, grinning disarmingly.

"Please let it help you, Dawn." His voice seemed warm and kind. "Life, I know, has been unkind to you. Hunger has hurt your body, and all your wounds must have scarred your mind a little. I think you've done wonderfully well, compensating paraphysically for all your handicaps. But still you need the grid."

Suddenly, then, she liked Ironsmith. She remembered the chewing gum he gave her once, and she thought his calm, sunburned face was very handsome, and she no longer felt afraid. She tried to smile at him, and tried to say:

"I'm ready, mister."

But something choked her, so she couldn't speak. Ironsmith waved at her cheerily, and then the silent power of the grid swept her into the warm and kindly dark of its healing oblivion.

XXXII.

Claypool found himself again, standing in his huge new room at Starmont. It seemed to him that only an instant had passed since he lay like a trapped and crippled

animal on the floor of the war museum at the Institute, and he automatically took his weight from his hurt knee.

Startled, he looked around him. The village swains and maidens still danced in the high murals, smiling in their luminous joy. The vast east window was now an amber screen, filling the room with mellow radiance. Beside him stood a humanoid.

The rich light filmed its slenderness with molten gold, and flamed on its yellow brand. It stood statuelike, an ideal shape of dark perfection. Its sightless, steel-eyed face was serenely kind, full of a sleepless solicitude. It was beautiful—and he shrank from it, stricken with his old terror.

"At your service, sir," its silvery voice sang softly. "What do you require?"

"Get out!" he said hoarsely. "Just leave me be."

To his voiceless astonishment, it obeyed. It turned silently, with that golden light flowing on its nude sleekness, and glided away from him. It paused to touch a button by the door—he saw that the old invisible relays, that a man couldn't work, must have been changed. The wide panel slid open for it, and closed behind it, and he was left alone.

He stood gaping after the departed machine—and discovered that he was standing on his crippled leg again. Strangely, it didn't hurt. He bent to feel his knee, and found the swelling gone. The flesh was firm and well. He walked across the soft floor, experimentally, and his step was light and sure.

"Huh!" He caught his breath. "Did Ironsmith's grid—?"

Then he remembered the long gash in his scalp, and he reached up to examine it. His fingers found no wound or scar, and the hair felt oddly thick. That slow, thudding pain, he realized, was gone from his head. In fact, he felt uncommonly well.

Curiously, he fingered his face. That caked stiffness of drying blood was gone, and the bristles of unshaven beard. He wanted a mirror, and his glance went automatically to a row of buttons beside that immense amber window. He selected one, not knowing why, and punched it.

The amber light went out. The window became a mirror. He goggled at a dark stranger. For the man in the mirror was taller and younger than he had been, not quite so skinny, lean and straight and fit. The deep furrows of worry were all smoothed away, as well as the petulant twist of the lips.

And those durable gray pajamas with the impregnable rhodomagnetic snaps were gone at last. The stranger in the mirror wore a neat blue suit, with a narrow conservative stripe and buttons that his own fingers could work. Claypool grinned with relief, and the tall stranger smiled back pleasantly.

But Ruth didn't like blue for him—

He remembered, then, with a stab of pain, that she was lost to him. A sudden sick loneliness cut through

him, but the dark-haired stranger in the mirror looked gravely cheerful still, and the straight shoulders made a quiet little shrug of calm acceptance.

Then he found the plaque, hung beside the mirror on the glowing wall. A thin rectangular block of some black crystal, polished sleek and golden-veined. Across the face of it was a green-lettered message—Ruth had always used green ink, and he knew her rapid printing:

Dear Webb,

Congratulations, on this Awakening Day. We're all three truly glad you're well again, and we rejoice in the new felicity which you should discover now.

The Frank Ironsmiths

Felicity—that was a pet word of Ruth's. The plaque had a slight, clean hint of Sweet Delirium. He read the message twice, and then a sudden stinging in his eyes blurred her neat green lettering.

With a painful throbbing in his throat, he found the round stud inset in the base of the plaque, and pressed it. The printing dissolved. The darkness of the crystal brightened, and the golden veinings faded.

The plaque became a window.

Beyond it, he saw a simple gay pavilion, which must have been erected by telurgy, standing on a happy landscape. The flowering trees about it were all violet flame, and light danced on far blue water, and soft green hills were topped with the silver towers of the Institute.

Frank Ironsmith and Ruth came out of that bright building, followed by a little yellow-haired girl. Ironsmith grinned at him warmly, and Ruth waved a white lace handkerchief. They hurried toward him in the picture, holding the hands of the slender child between them.

Ironsmith looked a little heavier, he thought, pink with health and calmly self-content. His smooth, sun-browned jaws moved a little, and Claypool thought he must be chewing gum. Ruth was straight and radiant, her dark hair lustrous with red lights.

They paused, in the picture. Beaming rather fatuously, he thought, Ironsmith took up the little girl. Ruth reached out to caress the yellow curls, and Claypool saw her fond and happy pride. She had never looked quite so young, he thought, not even on their own wedding day at Starmont, never so light and fair and gay.

The round stud clicked softly back again, and that tiny window closed itself. The polished crystal darkened, and the golden veinings knitted back. The green lettering was still erased, but that faint sweetness of Ruth's perfume lingered heavy in the air, a somber ghost of sorrow.

That stale sweetness seemed suddenly stifling in the room. His fingers went back, automatically, to the row of buttons beside the mirror. He glimpsed himself again, a tall brown stranger, and then the mirror became a crystal window.

He punched another button, and that clear panel dropped. A fresh morning breeze cooled his face.

Ruth's lingering thin perfume went out with the wind, and that ghost of old sadness with it. He inhaled clean air, and felt that he was free.

He turned to the window, and gaped again.

Far away, beyond the red expanse of the landing stage and below the uneven edge of the mountain's crown, he saw the rolling vastness of the desert he had known —but now no longer a tawny desolation.

For now new lakes glinted blue in the valleys, above giant dams the humanoids must have built, and scattered villas made gay islets of bright roof-color in a new sea of tender green, and now a somber green of new-grown forest clad the higher summits, which had been bleak and bare.

Dark forests, grown since he was here!

"That grid!" he breathed. "How long?"

He was turning to call back that oddly obedient machine to answer his baffled questions, when he caught a shimmer of moving color against the sky. A little rhodomagnetic cruiser dropped silently, the oval mirror of its hull aglow with blue and green reflections and the red of the landing stage. It touched gently, and a black mechanical sprang down to help a girl alight.

He stood at the window, watching that girl, and something caught his breath. He didn't know her, and yet something set a haunting wonder in him. Something made his pulse beat faster, and he forgot that vanished ghost of yesterday.

The girl left the humanoid waiting by the cruiser. She came obliquely across the stage, walking with a long, free, confident stride. She was tall, and splendid to him. Her flowing dress was clinging silver, scarlet-belted, and she wore a scarlet flower in her black, shining hair.

He didn't know her name, and yet the swinging way she walked awoke a haunting recognition. He must have seen her eyes before, long and limpidly dark. And the flower in her hair, a gay badge of courage, was somehow like a tattered scrap of scarlet ribbon.

She saw him at the window. Her half-remembered face—vivid-lipped and narrow, sensitive and strong, with high cheekbones—turned lovely with a smile he must have known, somewhere. She paused on the red stage, and called to him in a rich clear voice that he must have heard before.

"Hi, Webb!"

He didn't know her name, and yet that baffled recognition took hold of him. The tall stranger he had seen in the mirror waved back to her, and leaped over the low window ledge with a young man's effortless ease, and ran smiling eagerly to meet her. She gave him her hand, and her grasp was strong and glad.

"Do you feel all right?" But she didn't wait for him to say. "I felt you were ready to come back," she said happily. "So I asked Mr. White, and he told me this would be your Awakening Day. And he told me to come and welcome you—or at least he said I might."

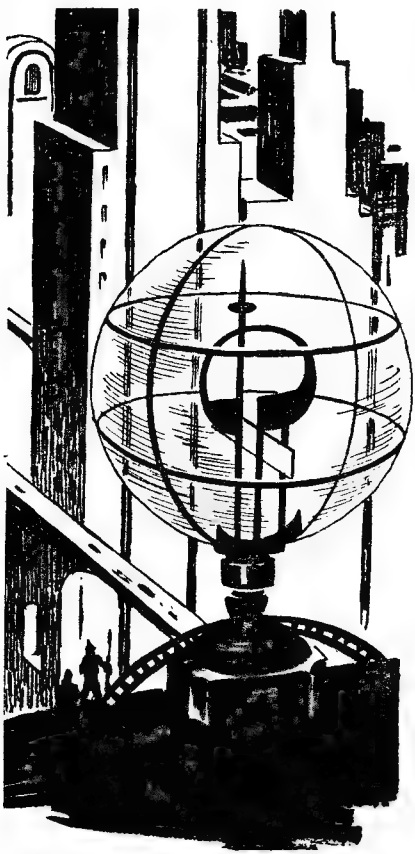
She saw his breathless uncertainty.

"What's the trouble, dear?" Her laughing voice held gentle malice. "Don't you remember me?"

He stared into her dark shining eyes.

"Dawn!" he whispered unbelievingly. "Could it be?"

"Perhaps I've changed a little, since you remember me." She straightened and posed in the clinging silver and turned herself before him, tall and gay and proud, laughing at him. "How do you like me now?"



He liked her more than he could understand, but he only nodded blankly, thinking of those dark forests grown on mountains that had been cragged and barren.

"How long has it been?" he whispered faintly. "How many years?"

"This is the fiftieth Awakening Day."

A cold wind blew on his spine.

"Awakening Day comes every year," she said, "when those who are ready are released from the grid. A great holiday. Mr. White wanted me to stay for the celebration at the Institute tonight. He has been back for thirty years, you know. Now he's a research man, working with Mr. Ironsmith."

Still Claypool couldn't speak.

"But I wouldn't stay," she said, "because I knew you'd be back, and I wanted to be here. Sometimes it is a little difficult and confusing, at first. I came back, at Dragonrock, on the last Awakening Day, and I remember being lonely."

He blinked at her shining loveliness, trying to understand.

"Mr. White and Mr. Ironsmith are always so busy, you see, with this new research. And our other old friends are still under the grid—Mr. White says that Mr. Graystone and Mr. Lucky should be ready in a few Awakening Days, but I'm afraid it will be a long time before poor Mr. Overstreet is out."

Her dark head tilted, and she smiled again.

"So I've been waiting for you, darling, alone at Dragonrock."

Floundering in his stunned confusion, Claypool groped for her warm hand, and let her laughing strength draw him back to sanity. He swallowed hard, and found his voice.

"Fifty years!" he whispered. "Then I'm—ninety!"

"And I am sixty," came her soft girl's voice. "The grid works slowly—Mr. White and Mr. Ironsmith are working now to speed up the processes. But it has healed our bodies and our minds, and it can make us young again."

Her limpid eyes turned thoughtful.

"Darling, isn't it strange we were so awfully wrong? And too bad we ever fought Mr. Ironsmith?"

He looked over her shoulder, at the computing section where Ironsmith used to work. The old evergreens clumped about it were taller, now, and the little red-roofed building sagged with age. Against the white-painted wall, where Ironsmith used to lean his bicycle, stood a tall memorial tablet.

Claypool nodded dazedly.

"I guess we were all of us sick and blundering and mistaken," he said slowly. "I guess Ironsmith is a shining genius and a great hero—but still I don't like that habit of chewing gum."

The tall girl laughed throatily.

"Darling, I'm glad you're still you. 'Cause I've been waiting for you." Somehow, then, in her rich husky voice, he could hear a child's clear treble. "You see, Webb, I've been in love with you ever since the day you carried me in your arms, and ran from that digging machine. 'Member?"

Claypool remembered. The tall youthful stranger of the mirror heard the music of her voice, and caught her hand again. He wanted flowers to give her, and swift telurgy shaped red and thornless roses from the air.

But he remembered those fifty years again, and the shock of them checked that stranger's smiling confidence. The telurgic roses in his hand somehow had the musky odor of Sweet Delirium, and they recalled that ghost of sadness he had tried to banish.

Dawn took the flowers from his numbed hand, laughing.

"It's no use, your fighting, dear." Her voice had a faintly malicious bite. "And no use to dream of Ruth. 'Cause I came to see you here, right after my Awakening Day. I liked you, and I told Mr. White I wanted you, and he fixed it for me in the grid. He says you simply can't hate me now."

THE END.

* * * * * * * * * *

IN TIMES TO COME

In this issue, we are starting the presentation of a new policy—advertising space is available for sale in Astounding Science Fiction alone. Normally, in a general-circulation magazine, ads tend to be simply a space-waster from the reader's viewpoint; in the past, to a considerable extent, I fear that they have been so in Astounding. In special-group magazines, however, advertisements properly selected for that special group serve a definite and useful purpose to both reader and advertiser. The advertiser's interest is, of course, obvious; in the special-group magazine though, the reader is as much interested. In the present issue there are several ads for science-fiction and fantasy books that you might not have heard of, or might have forgotten, books you'll be interested in knowing about, because they are of interest to your particular field of interest. Such ads serve as bulletin boards to keep you aware of what's happening in this field. In just such a way, ads in technical journals help the specialists in their own fields to keep track of the latest manufacturer's offerings—they serve as a running, up-to-date catalogue. So, we hope, will Astounding. We intend the ads to be useful to you, as well as to the advertisers. (P.S. We might mention they help balance our rising costs, too!)

Several of the ads contain coupons; knowing you don't like marring the magazine, we've done our best to make those ads back on non-story pages, to encourage coupon use. Reason: The advertiser wants to know whether a particular ad in a particular medium pays off—and the coupon identifies the place you saw the ad. In replying, if you don't use the coupon, mention the magazine, will you? More results mean more ads—and that means we can afford to expand the magazine as we want to, despite the high cost of paper.

But to next month's issue. It starts "Dreadful Sanctuary," by Eric Frank Russell, a fast-moving novel with a fascinating, unprovable proposition. And the even more intriguing point that, whether that proposition be true or false, the behavior of the villains of the piece will be the same! Russell always could write—and he's up to the top of his form on this one!

Also coming up is a brief piece ". . . That Only A Mother . . ." by Judith Merril, the first new feminine science-fiction writer in years. It's a smooth piece all the way through—with a hornet sting barbed on the end. You'll remember it.

THE EDITOR.

The mathematicians went to work on servos about 1840. Particular mention should be made of Wischnegradsky's work in 1876, because its advanced mathematics and Russian language virtually doomed it to oblivion.

In 1884 Knowles devised an isochronous governor which, of necessity, used positive feedback. Without going into the theory, you may be assured that positive feedback is one of the gremlins which makes life interesting for the servo engineer.

The steam steering gear for ships antedates 1890 and the Sperry devices were full of servos. Spetry had an operative autopilot for airplanes during World War I.

Leaving the mechanical and hydraulic servos, we find that Edison invented the first electronic servo in the form of a voltage regulator in 1882, on paper. This was forgotten for about forty years, until it was found misclassified in the Patent Office during litigation over the reinvention and reduction to practice, of an electronic voltage regulator by Stoller in 1918.

During the thirties the mathematicians again got busy on "feedback". Black recognized the usefulness of feedback amplifiers, Nuquist derived his famous "criterion" for stability and Bode carried on by analyzing the limitations of practical systems. These studies were theoretical and primarily intended for amplifiers rather than mechanisms, but it was not too long before the servo engineers drafted the theory and later the theorists. Not to make the servos work, but as we have mentioned, to make them work one decimal place better.

At that, the servo engineers had their mathematical analysts. The use of velocity feedback was used, analyzed and patented in the twenties. Ninorsky who analyzed the problem of automatic steering and Hazen in the *Journal of the Franklin Institute,* circa 1939, presented substantially the same material as was to be found carefully locked up in "classified" files in 1944.

World War II refined servos and used them extensively but is not in any way responsible for their basic development and application. —Fred Nash, Charles Revell—Laboratory of Unnatural Science, Long Island Division.

Sorry, Prime Press—and you're right. It's an even better bargain.

Dear Mr. Campbell:

On behalf of the Prime Press I'd like to thank you for your review of our publication "The Mislaid Charm." We think the story good and are always interested to receive public notices.

However, would it be possible for you to run a line or so at some early future date, correcting the price from $3 to $1.75? Mr. de Camp says it's a good value at $3. We are sure it's more so at the correct price of $1.75.—James A. Williams, The Prime Press, Box 2019, Middle City Station, Philadelphia 3, Pa.

Hm-m-m—best of the decade. Look, suppose you were getting out an anthology, 1940 to date, and had to pick the ten best stories of novelette or short length—no novels. What would you pick then? It's unfair to shorter stories to match them against novels.

Dear Mr. Campbell:

Having been out of touch with Astounding for the last couple of years, I noticed only recently the changes that your magazine has undergone—such as the elimination of the word ASTOUNDING in large type, to be replaced by the more subdued SCIENCE FICTION—the return of Rogers to the covers—who should be relieved by liberal doses of Timmins now and then—the return of some of the better authors and last, but most certainly, far from least, the improvement in the quality of paper. Are you preparing us for the day when old AST. will shed the last of its pulp and emerge on the newsstands in bright slick garb? More power to you, if you are.

Personally, I hope you maintain the present size until that day, but even a return to the normal pulp size is preferable to the large monsters of '42. My copies from '37 to the end of '41 are in as fine shape as can be expected with a minimum of care, but the large issues, almost to a copy, are frayed, torn, and in general poor condition. Furthermore, they are not as handy to bind or store, waste far too much paper and are not nearly the advantage you thought they would be. Please retain the size you now have. It's neat, handles well, is attractive on the newsstands and is just as dignified as any of the Digest magazines, despite the somewhat flamboyant covers.

You've heard this before, I know, but perhaps you'd like to get my selection of the best stories so far in this decade—when 1950 rolls around, if you're still publishing, I'll finish it off—but here they are, with no preference to place values. These are the best since 1940, arranged chronologically:

"Final Blackout" Hubbard—really excellent.

"Slan" van Vogt

"Sixth Column" MacDonald

"Common Sense" Heinlein

"Beyond This Horizon" MacDonald

"Nerves" Del Rey

"Opposites—React!" Stewart

"World of A" van Vogt

"The Mule" Asimov

"The Fairy Chessman" (Lost my copies)

"Fury" O'Donnell

"The End is Not Yet" Hubbard

Despite some nostalgic tears for the years of '40 and '41, I must admit that excellent stories have appeared since then, though with less frequency. "Opposites—React!" impressed me very favorably, although I notice it failed to rate the MUTANT label.

Which raises some more questions, to wit: what has become of MUTANT ratings? NOVA ratings? Book Jacket illustrations on serials? Will Stewart?

On the other hand, you're just as well off without: Alejandro; the Isip brothers; and too many sequels.

The loss of the rotogravure section, I suppose, is due to the paper shortage, or perhaps has bowed out in favor of the better quality paper used throughout.

You raised an interesting point not so long ago, in connection with Murray Leinster's story, "Propagandist," in wondering at the response on a story with such an obviously emotional background. After all, if we wanted to read stories purely for the sake of the technology, past, present, or future, we could pick up a history book, handbook, or indulge in some hefty experimentation. Your own stories depended not on the technological aspect of the surroundings in the story, but on the psychological and emotional factors involved. I'm glad that you carried your ideas with you into Astounding, for it has completely changed science-fiction, and, in my opinion, most certainly for the better. However, a story that is neither wholly psychological nor wholly technological is the most absorbing. Too much implied science also becomes boring, as witness Doc Smith's so-called epics.—John L. Gergen, 221 Melbourne Avenue S.E., Minneapolis, 14, Minnesota.

Smith put that final note on "Children" to make it definite, certain and unequivocally clear that this was all—the end—the finish of the series. But still people don't believe him!

Dear Mr. Campbell:

Have just finished reading "Children of the Lens", and would like to add my note to the chorus of praise you will no doubt soon be hearing. Some may consider the Lens series just a highly streamline diversion of the old "space pirate" idea, but what, I ask you, was ever wrong with space pirates, properly presented?

It would be very interesting to get a frank statement from Dr. Smith as to how the series took shape in his mind. I strongly suspect that the idea of Eddore was a very late development, and that if one were to turn to the original serial version of "Triplanetary" it would be impossible to distinguish the Eddorian entity beneath the surface of Gray Roger, nor would Virgil Samms be recognized as a Grandpappy Kinnison. Incidentally, I've always regretted not having been able to read more than the first installment of the story when it appeared in 1934. No doubt when it presently appears in book form, it will be completely rewritten and fitted perfectly into the pattern of its sequels.

When "Galactic Patrol" first appeared how far into the depths of Boskonia was Dr. Smith looking? Not much, if any, beyond Helmuth the "Speaker" I'd say. In fact I doubt if Eddore had occurred to him even when Kinnison was cavorting with the Eich.

Be that as it may he always left himself an out, and as it now stands,

the various parts hang well together. When Dr. Smith winds up the saga with the further adventures of Mr. Samms as "First Lensman" I'll be right in line for my copy.

Lastly, is there discernible in the final sentences of "Children of the Lens" a hint of things to come? Will we see in the not too distant future a Fourth-Stage Guardian or a Lensman's Successor? I'd hate to bet we wouldn't.—J. R. Mills, 545 North Main Street, Wallingford, Connecticut.

Well, that wasn't Alejandro's idea about the rays from the head—but there is point to what you say.

Dear Mr. Campbell:

After all the fanfare it received "Children Of The Lens" has been a disappointment to me. I have read Smith's work before and liked it, but you could have cut it in half without losing anything.

The stories rate as follows:

1. "There Is No Defense"
2. "New Lives For Old"
3. "Cosmetics" (This was very good, but look what it had to compete with.)
4. "Children Of The Lens"

As for the cover, hm-m-m—another of Alejandro's symbolic paintings. The first of his super covers seemed to symbolize man's attempt to reach the stars. This one no doubt symbolizes his conquest of the atom. But why the radiations emitting from his head? Does this indicate that despite his physical progress he still has holes in the head? Or does it mean that man has a tendency to be hotheaded? Either way Alejandro is probably right.

Seriously these covers of yours are the best art I have seen any place. They should win all art contests hands down. I'll bet that in a few years an original Alejandro will be worth a fortune.

I like your policy of including more stories based on biology. Maybe its because I'm a biologist. I know a lot of biologists who haven't read your magazine because there has been very little of biological interest in it. However now maybe they, too, will join the list of readers of Astounding.

I like your editorials, too. In fact come to think of it I like everything about Astounding. However it could be a lot larger and *Unknown* could be brought out of its state of suspended animation. That would make everything perfect.—R. W. Johnson, 3835 North Central Park Avenue, Chicago 18, Illinois.

Well, you're right and you're wrong. E. Mayne Hull does have the feminine viewpoint all right, and it is, in a sense, a pen name. But not C. L. Moore. E.M.H. is Mrs. A. E. van Vogt.

Dear John:

Well, the new year is well under way. The January issue sports Rogers' fine cover. Doc Smith and Asimov are the only familiar names

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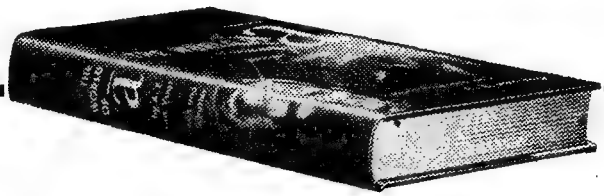

THAT was what Astounding Science editor John Campbell called A. E. van Vogt's story THE WORLD OF ā, when it was first introduced as a serial in this magazine several years ago. Now you will be glad to hear that THE WORLD OF ā has been revised and edited for book publication, so that you may add it as a bound volume to your permanent science-fiction collection. If ever you have fallen under the spell of van Vogt's story telling, this is all you should need to know before asking for THE WORLD OF ā at your bookstore. Or you may use this coupon to order a copy by mail. Price $2.50. SIMON AND SCHUSTER, Publishers.

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that elicit any kind of response. These new authors! Here is one fan who is lost. It's hard as all get-out to figure out who's who. The Christmas holidays gave me a chance to haunt my files, and after quite a bit of scrounging around, managed to find Catherine Moore's new pseudonym. It was quite a hunt, but always look for the woman's viewpoint—Blord's secretaries; the matriarchy of the S. Clen in "The Winged Man"; Cyrille. The female psychology always manages to seep through despite a woman writer's efforts. However she did pretty good this time howsomever taking in the possibility of Hank's outlook. Perhaps it just runs in the family—two minds with but a single thought?

Finally made it objectively through "Science and Sanity" and just want to say that even if van Vogt's conclusions *were* a bit final, "World of Ā" absolutely needs a sequel. The description of the Prescots was good interpolation of what Ā could do for the masses, even if *they* were highly trained technicians. But throughout, there is a good cross-section of Non-Aristotelian personalities, disregarding van Vogt's over-writing and super-novel technique. I reiterate, "World" needs a sequel. Ditch the Atom Gods.

Use Alejandro on first issue of *Unknown Worlds* when it is reinstated—he's great. Would also appreciate a letter from you with pen names and real names of some of your authors, as I know it isn't jake to enclose them in the editorial caption above this letter. Your superlative articles, as usual, spike the issue, and your *own* is always critical mass to setting off a pleasant and absorbing evening. — Ernie Auerbach, University Veteran's Housing, Box 813, Coral Gables 34, Florida.

Dr. Rhine of Duke has investigated clairvoyance—but somehow I still don't think the pendulum has anything to do with it!

Dear Mr. Campbell:

I thought you might be interested in the following: If I remember rightly, you published a story—article—by Willy Ley some time last year, dealing with the German pendulum theory.

It so happens that I get a regular supply of Flemish newspapers from Belgium, where I lived the first quarter of my life up to the war. A few days ago I came across an article in one of the best publications, namely *De Nieuwe Gids* (The New Guide, i.e.), of December 17, 1947. One of its reporters, signing himself Jaak Veltman, referring to the pendulum theory in that article, says among other things:

"Take for instance the woman living in the neighborhood of Tournai, who had not heard from her son for three years. He had been deported to Germany in 1942 and his last letter was dated 1943. When she received no news even after the capitulation, she made inquiries left and right. However, nobody was able to help her and she was just

about to give up the search when she found out that the pastor of a neighboring village had cleared up other disappearances.

"Taking her son's photo with her, she told of her misfortune. The priest calmed her and produced a map of Germany. Placing a finger on the photo and holding in the other hand a pendulum which he moved over the map, he searched intently for a while and, addressing smilingly the woman who had been looking at him with nervous astonishment, he said calmly: 'Your child lives, and I believe even that he is residing in this locality'. (He indicated Darmstadt).

"'Will I see him again, Father,' the woman queried. 'If you could only tell me . . .'

"'I have a feeling that he is on a journey,' the priest replied, 'but would prefer to verify this first. Can you come back later?'

"When she returned, he was able to tell her that the young man was on his way to Belgium and he thought it safe to predict that her son would be home by Ascension Day.

"The woman did not know what to make of it. Caught between doubt and faith, she spent an anxious time. When Ascension Day arrived, the bell rang during the afternoon and—her son stood before her.

"The story was told to me in a sober, cool room of a convent, by a padre who is a serious and learned scholar."

The World of Ā

by A. E. VAN VOGT

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Phew. Well, that is a verbal translation. Sorry it is a bit long. Whether it is true, of course—Only the people concerned know.

While I am at it, there are three more points I would like to mention: a) I thought the cover picture for Aesop the best I have ever seen. I believe it was mostly the coloring that appealed to me.

b) You may not care a bit, of course, but frankly, I do not think much of most of the illustrations nowadays. I would have expected to find drawings, showing scenery or mechanisms, or so, which may—or may not—be used in future ages. Instead, all we get is the head of a man, or a woman, or a dog. Now and then a man or woman are shown in full, and a table or chair is added to fill the picture, so to speak. I sometimes wonder what Nadreck or Worsel are supposed to look like.—Michael Corpor, 114 Tachbrook Street, Westminster, London, S. W. 1, England.

Universal suffrage—limited only by the reach of United States mails!

Dear Mr. Campbell:

Following a New Year's resolve to use my readers' suffrage on your enjoyable magazine, here are my votes on the January issue.

1. "Now You See It." Very good indeed; this series is still ascending in interest.

2. "Helping Hand."

"Advent."

Both enjoyable, though I doubt that I'd reread them; but then, it seems to me that the enjoyable stories are a sort of backbone of a good magazine. You can't have excellent ones all the time, every time.

3. "Children of the Lens". Only moderately interesting in spots so far, and even this is pretty well obviated by the poor writing and ridiculous characterization. I suppose I'm much in the minority, but my opinion is that this doesn't belong in Astounding SCIENCE FICTION.—E. C. Marshall, 306 West 11th Street, New York 14, New York.

To The Point!

Dear Sir:

For once a novel which is superior to any I have read for quite some time. Naturally I am referring to Dr. Smith's "Children of the Lens".

I do hope you can give us some more of Smith's work very soon.—Mary L. Henninger, P.O. Box 890, Bradenton, Florida.

We've got plans for changing and improving Science Fiction!

Dear Mr. Campbell:

Here goes for my first attempt at rating stories in Astounding—after enjoying your magazine since 1934. For 1947 I rate the outstanding stories in this order:

1. "Children of the Lens," by E. E. Smith (must rate first).

2. "Hobbyist," by Eric Frank Russell (best short story in years).

3. "Tiny and the Monster," by Theodore Sturgeon (also very good).

4. "Ole Doc Methuselah," by René Lafayette.

5. "The Figure," by Edward Grendon (short, but o my).

6. "The Person from Porlock," by Raymond F. Jones.

7. "Sinecure 6," by Horace B. Fyfe.

8. "The Expensive Slaves," by René Lafayette (good new man).

9. "Propagandist," by Murray Leinster.

10. "The Equalizer," by Jack Williamson.

11. "With Folded Hands," by Williamson.

12. "The Timid Tiger," by Russell.

13. "The Answer," by George O. Smith (he writes too much).

14. "The Model Shop," by Jones.

15. "Answer," by Hal Clement.

The year was outstanding in quality of short stories but not so much could be said for the serials, which were not outstanding except for "Children of the Lens." Of the other serials, I liked "Tomorrow and Tomorrow," by Lewis Padgett best with L. Ron Hubbard's effort not clicking with me. But then, I didn't like his "Final Blackout" either.

Worst stories: 1. "The Thing on Outer Shoal," P. Schuyler Miller; 2. "An Enemy of Knowledge," by A. M. Phillips (belongs in some other pseudo-science-fiction maga-

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zine); 3. "Turning Point," by Pendleton Banks.

With the advent of the final Lensmen story, the whole series begins to take on perspective, and one can see the reason for some passages in earlier stories. Eddore was mentioned in "Second-Stage Lensmen." However, Smith needs to polish up his introduction to the series as well as to finish the present serial in the February issue. I guess he'll do it in his re-written "Triplanetary," which Fantasy Press will publish next year.

Your articles remain tops in their field, and I'd like to see more of them. I hope that some day you'll go back to a large size, put in slick paper, and publish a real magazine with lots of stories, lots of articles, and lots of pictures. Until then Astounding will remain the best of the pulps, which is a derogatory term to most people. Our magazine isn't like most other pulps, we hope. At any rate, I have not been able to read any other science-fiction magazine for several years; they don't compare with Astounding.—Edward L. Corton, Jr., 709 West Third Street, Waterloo, Iowa.

Concerning the "Megapolis."

Dear John:

My ballot for the February SCIENCE FICTION herewith:

(1) "There is No Defense"—the jigger was suspect to an old whodunit fan, but it was nicely developed.

(2) "Children of the Lens"

(3) "New Lives for Old"

(4) "Cosmetics"

Not by any means a super-issue.

Your editorial, "Megapolis," should send some serious readers to a paper by John Q. Stewart in *Geographical Review* for July, 1947, entitled "Empirical Mathematical Rules Concerning the Distribution and Equilibrium of Population." Granted that Stewart has derived his equations by trial, from study of population statistics, and that they therefore represent a kind of summation of our culture—and that you are assuming a changed culture—his results are interesting, and may have a good deal to do with our immediate future.

Atomic war—or Van Vogt's walls—are elements which can only bring about radical and sudden culture changes—not evolution, really, but revolution. If we avoid the first and fail to achieve the second, Stewart's equations indicate that our larger urban centers will continue to attract population at the expense of rural areas. He is speaking of physical, and not of political cities, of course. Physical New York includes much of New Jersey and Westchester. Physical Schenectady may rather soon involve Albany, Troy, and the suburbs of Rensselaer, Watervliet, Cohoes, Waterford, *et al.* which have political identity but are contiguous to the latter two cities.

Not much more than fifty years ago—say seventy-five—villages scattered through this part of New York State were still real urban units—perhaps as large as some "cities" of

early Mesopotamia or Egypt. They had their own local industries, schools, churches, and newspapers. They and the farmland around them, which produced food on a subsistence rather than a one-crop basis, formed more or less self-sufficient units.

Around the turn of the century, there was a change to urban concentration. Here the direct cause was the establishment in Schenectady first of the Edison Works, and then of its transformation into General Electric. It was no longer economical for young people to stay in their cross-roads villages and make shoes or brooms or boxes by hand when they could work in the G.E. for more money. It was no longer economical for them to live twenty miles away and commute by horse and buggy, so they moved to the city, which grew like a toadstool. This had happened earlier elsewhere, and probably is still happening in some rural areas where industrial plants have recently been set up.

The automobile both helped and counteracted this trend. It helped by making central urban shopping centers, amusement resorts, churches, *et al* more accessible and perhaps more attractive. The small-town equivalents for the most part died off, and left the urban centers in sole command. People from great areas of the United States come to New York for opera, theater, museums, libraries, and shopping, because equivalent facilities

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cannot support themselves in small places.

Supporting these facilities, and the accompanying public services such as sewers, power, telephones, pavements, police and fire protection, and schools, costs a good deal. To avoid paying high city taxes—and because the automobile will now carry them easily and quickly—decentralization is taking place, but usually concentrically around the urban centers. Eventually these suburbs are going to find that their local taxes are higher than those in the city they left, and will ask to be taken into the political structure to which they belong physically.

This kind of decentralization still leaves a pretty big target on the map for an A-bomb. It is really diffusion. Life under atomic war is more likely to produce—if there is time—something more like fission, with fragments of population spattered over the landscape as far from each other as they can get. And this means radical economic changes as to public services and the service occupations. Stewart may have to work out an entirely new set of equations for such a society—or he may find that the basic equations still hold, if properly applied and with changed constants. If society does not break back to the rural pattern of the middle Nineteenth century, with self-sustaining localities—and we have probably destroyed too much soil, timber, and watershed for this to be possible—something fancy in transportation and social organization will have to develop. Perhaps there will be local cooperative general stores—branches of some central store which can handle distribution on a nation-wide scale. Central schools will be necessary, if only to make it economically possible to offer specialized courses and use specialized equipment. (A one-room country school could have a laboratory course in nuclear physics if anyone could pay for it.) And eventually you may see a set of Stewart equations applying to a physically scattered politically unified "city" stretching from here to Canada, as his present set describe the physical centers of today.

There is a pretty problem for a writer with a solid background of sociology—given the pattern of our Western Civilization, and those of the neighboring civilizations of which Toynbee speaks—what new patterns will be created by an atomic war, or a bacterial war, or any other set of conditions which cause a sudden rather than a gradual change? When Mars is colonized, will it follow the evolutionary history of human society here on Earth, or something different? Is decentralization possible on such an airless planet as the Moon? I'll be watching for the answers in SCIENCE FICTION. —P. Schuyler Miller.

THE END.

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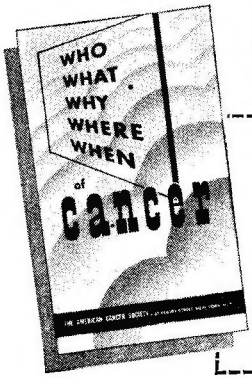

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